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TELEPHONE ENGINEER

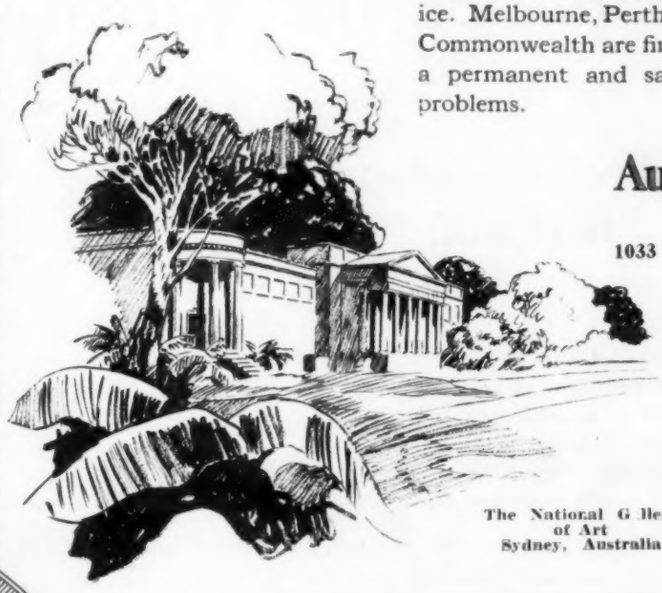
VOL. 30, No. 12. DECEMBER, 1926 CHICAGO

Beyond the Horizon--

OVER the farthest edge of the world lies one of the world's great commonwealths. Founded in 1788 as a far outpost of the British Empire, Australia, through the progressive spirit and energy of the pioneers who settled there, has become one of the most prosperous of countries.

The realization that without adequate and up-to-date telephone systems no country can continue to thrive, early prompted the engineers of the Australian Post Office to adopt Strowger Automatic equipment as a standard for telephone service in its more important cities.

The conversion of Sydney's telephone system to Strowger Automatic, begun in 1914, has now progressed until today the greater part of that city is enjoying Strowger Automatic service. Melbourne, Perth, Brisbane and many other cities of the Commonwealth are finding in Strowger Automatic equipment a permanent and satisfactory solution to their telephone problems.



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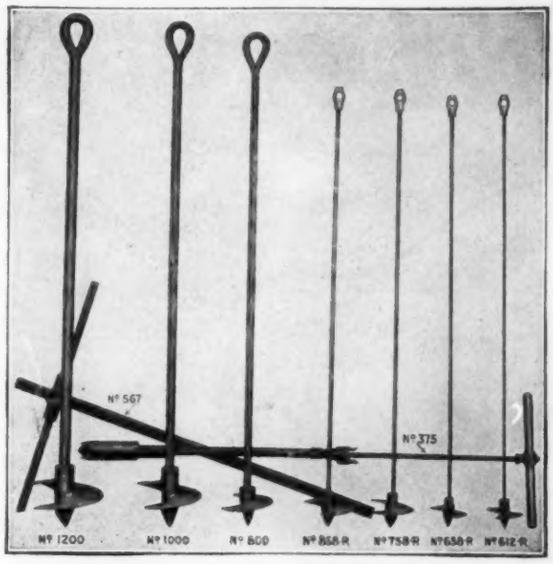

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To meet every type of need for dependable anchorage, Matthews Scrulix Anchors are made in 7 different sizes. For all ordinary requirements, comparatively small and very convenient sizes prove entirely satisfactory, but if you require a larger size there is a Matthews Scrulix Anchor to meet your particular need.

Don't attempt to estimate the holding power of Matthews Scrulix Anchors by glancing at them. Let these amazing anchors prove their merit to you. Both the ease of installation under all conditions and the astonishing holding power are due directly to the helix of the Matthews Scrulix Anchor. Briefly we cover details here, but for complete, interesting information, read Bulletin 800.

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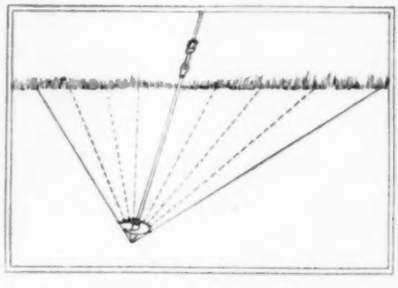

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Read interesting details of installations and gain more thorough knowledge of Matthews Scrulix Anchors. See just what they mean to you. We will gladly send you this bulletin upon request.

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Good telephone service increases the calling rate, but at the same time increases the demand for telephones and builds up the revenue in all departments of the exchange.

Good telephone service helps the operating telephone company and the subscribers, boosts business and makes for greater prosperity in the community.

Kellogg Universal is in reality a Common Battery switchboard operating on Magneto lines which may be changed to common battery, one at a time or in groups, by simply changing two wires at the relay rack. It may be changed from non-multiple to multiple by adding only the necessary cut-off relays and multiple jacks.

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Kellogg Universal eliminates dry cells and hand generators.

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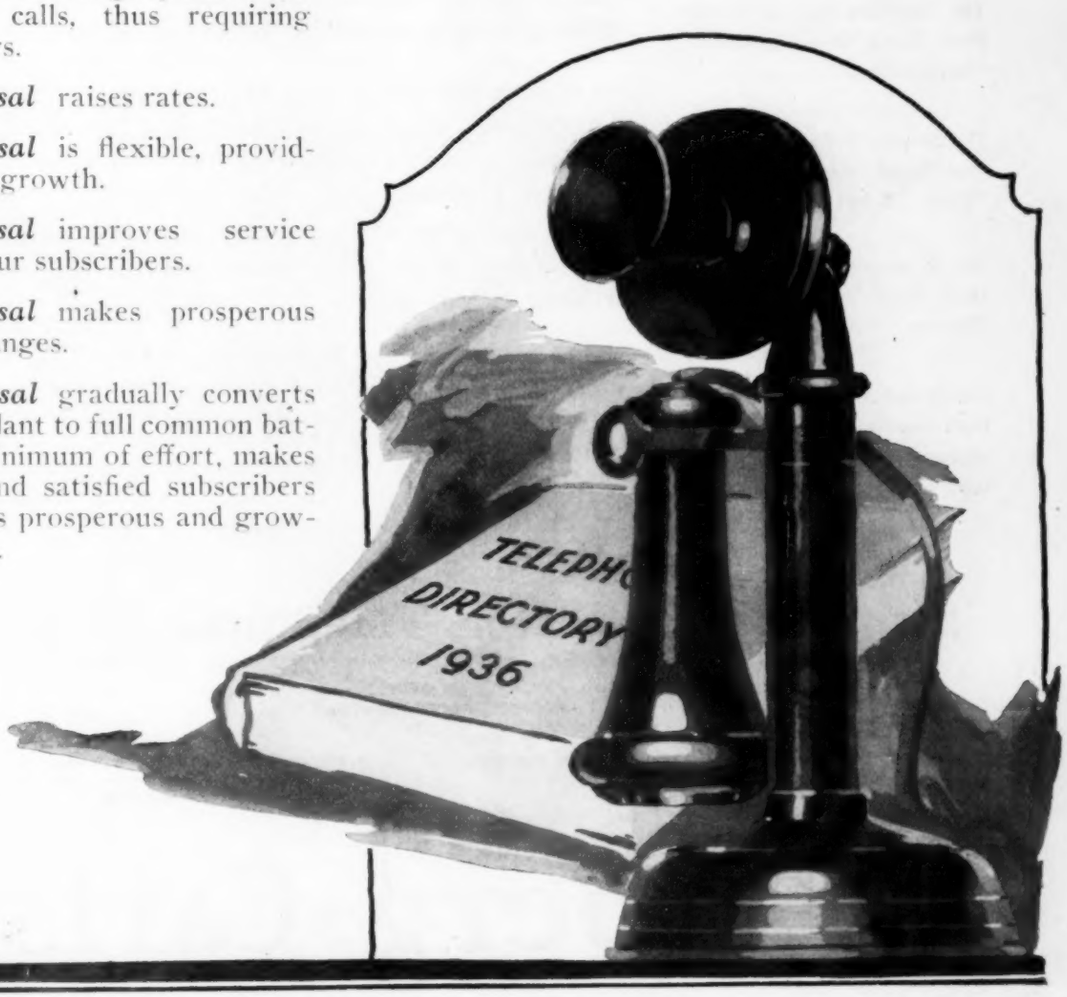
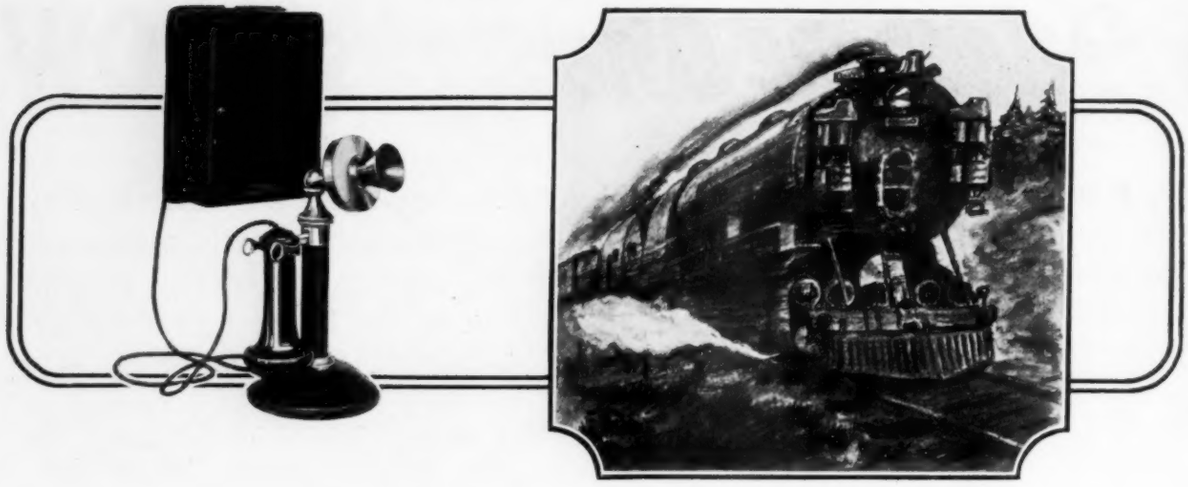
Kellogg Universal improves service and pleases your subscribers.

Kellogg Universal makes prosperous growing exchanges.

Kellogg Universal gradually converts the magneto plant to full common battery with a minimum of effort, makes enthusiastic and satisfied subscribers and establishes prosperous and growing exchanges.





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The Stromberg-Carlson No. 986 Desk Stand is equipped with "Duratex Brown Silk Cords."

The Stromberg-Carlson No. 986 Desk Stand is equipped with "Bakelite Parts."

The Stromberg-Carlson No. 986 Desk Stand is equipped with a "Highly Efficient Transmitter."

The Stromberg-Carlson No. 986 Desk Stand is equipped with "Booster Talking Circuit."

The Stromberg-Carlson No. 986 Desk Stand is furnished with desk set boxes of the "Concealed Gong" type.

The fast locomotive is valuable to the railroad company because of the economies and increased revenue it makes possible—more trains can be run; cars are occupied for a shorter time; and passengers are willing to pay more for better service.

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These conditions are brought about by the use of a Highly Efficient Transmitter and Booster Talking Circuit—both Stromberg-Carlson features which make talking and hearing easy.

Write for Bulletin No. 115

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Stromberg-Carlson

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Oskaloosa Home Telephone Company, Oskaloosa, Iowa, Appanoose County Telephone Company, Centerville, Iowa and Farmers Mutual Telephone Company, Clarinda, Iowa already are operating Stromberg-Carlson Super-Service Switchboards.

Write for Bulletin No. 117

Seventeen Features of the Stromberg-Carlson Super-Service Switchboard:

- Operator's Cut-In
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- Operator's Secret Service
- Audible Busy Test
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- Ringing Tone
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- Reverting Call Ringing
- Dark Keyboard
- Positive Supervision
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- Call Registration
- Emergency Ringing
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Illustration shows portable size for pole work

Prest-O-Lite Gas

"The gas of a thousand uses"

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LABORATORY test results on Columbia Gray Label Telephone Dry Cell economy surprise everyone who sees them unless they have used these surprisingly long-lasting batteries. So we suggest just this: Order a barrel and put them in service. Let them prove for themselves that their longer shelf life means less cost per month of service. Fahnestock spring clip binding posts at no extra cost.

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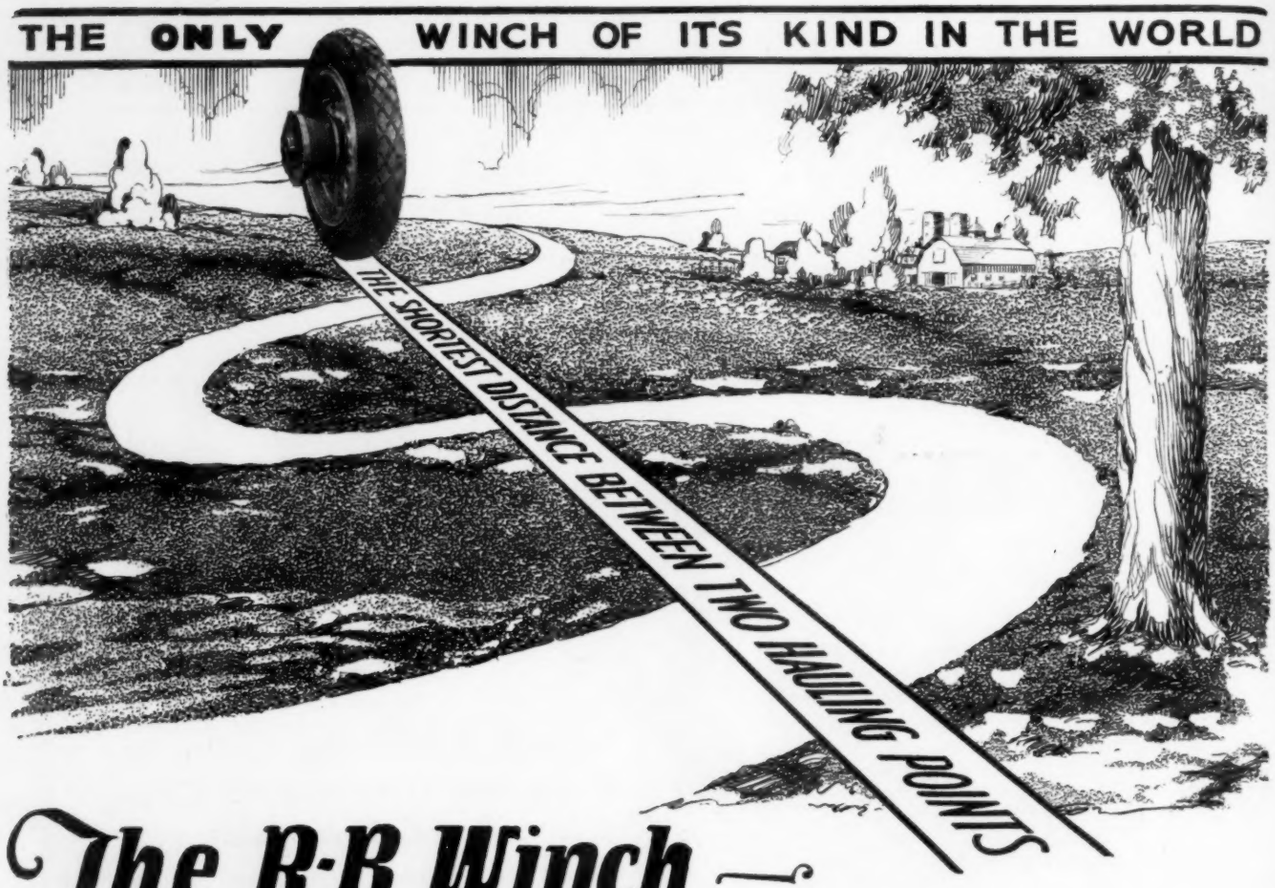

The R-B Winch is the short cut to Profits

Less **loading** and **unloading** time means quicker **hauling** time. The precious minutes and hours you now waste in loading and unloading without adequate winch equipment can be **saved** with an R-B Winch.

RELIABLE TRADE BRADEN MARK PRODUCTS

The R-B Winch saves time, money and labor, because it is the fastest and easiest-operating winch in the world. The utmost in winch efficiency is represented by the R-B Winch's principle of operation. It takes its power direct from the rear axle, without the necessity of jacking up the wheel, when loading or unloading.

The R-B Winch costs less and weighs less. It occupies no bed space on the truck. It costs practically nothing to maintain. It lasts longer because it has only **two** moving parts. Write for full information.

THE BRADEN STEEL & WINCH COMPANY
Tulsa, *Sole Manufacturers* **Oklahoma**

THE R-B WINCH

OPERATES INDEPENDENT OF WHEEL

NO NEED OF JACKING UP WHEEL

Texas "Black Beauty" Poles along the line of the Tampico-El Higo Railway, Vera Cruz, Mexico.

2T6

They Are "Standing Up" in Old Mexico

No service conditions are harder on poles than those of the tropical climate—for here destructive forces are indeed rampant—and the service life of untreated poles is ordinarily but a few short years.

On the other hand, Texas "Black Beauty" Poles will serve for generations in the tropics without being affected by termites, decay or the other agents of destruction. Scientific creosoting, full length, by the vacuum-pressure method, makes these poles chemically inert and toxic to all insects and decay-producing fungi—and their great natural strength is thus preserved through many years of service.

Whether amid the snow and ice storms of the North, or in the Tropics—in the mountains or on the plains — Texas "Black Beauty" Creosoted Southern Yellow Pine Poles "stand up" and faithfully carry their load.

Texas Creosoting Company

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Place this arrester wherever your lines are exposed to unusual lightning conditions. Ten lines or five pairs of protection at nominal first cost.

Prices, samples and additional information on request.

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Old Scout

These ground hogs call a spud a spud

They're sticklers for words, these Graybar groundhogs!

"Spud," to a Graybar Electric man means just exactly that. And the same holds true for any other word on an order for line materials or tools. Which, to old scouts working out on the lines, bespeaks orders properly filled and properly delivered at the proper time.

This art of being a really skillful groundhog comes only after years of practice. Graybar Electric, succeeding the supply department of Western Electric, has had 56 years of schooling in service to the electrical industry.

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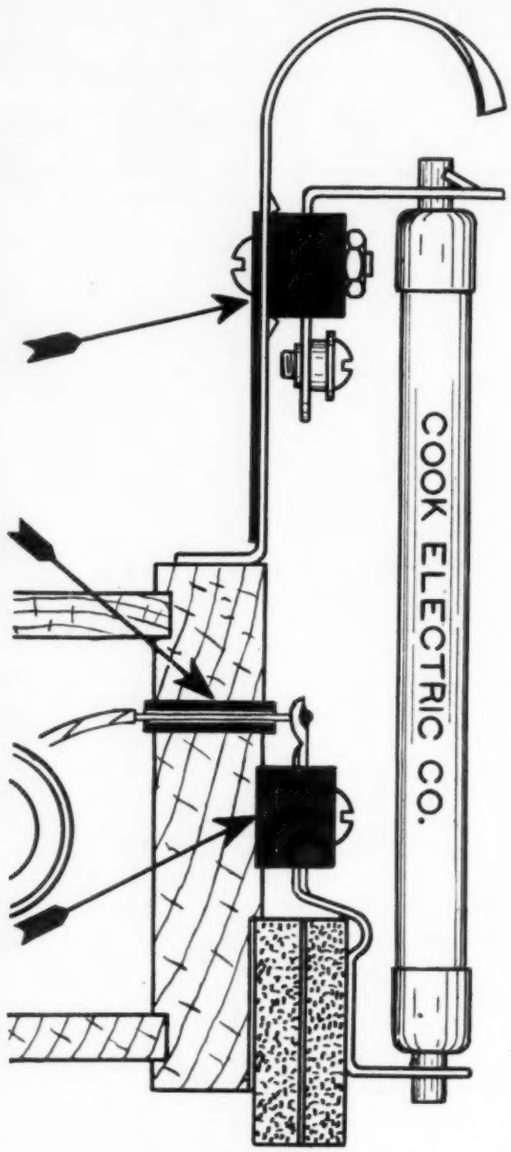

No Other Wooden Core Box Terminal Has Such Perfect Insulation

Full Particulars On Request.

COOK ELECTRIC COMPANY

Chicago

TELEPHONE ENGINEER

Volume 30 DECEMBER, 1926 Number 12

IS TELEPHONE CANVASSING A NUISANCE?

A service complaint, rather out of the ordinary run, came to a telephone manager in a certain city, recently. A subscriber called the manager and asked if some way might not be found to prevent his residence telephone being called by people conducting sales campaigns by telephone. The complainant said that scarcely a day passed when his wife was not called to the telephone by agents selling household appliances, articles of clothing, toilet preparations, dress patterns and all manner of merchandise, and these repeated calls had become very annoying. After giving the matter some consideration, the manager was able to suggest only one remedy that might be applied, namely, the withdrawal of the telephone directory listing, which might or might not be a solution.

This, probably, was an aggravated case where the housewife felt keenly her inability to apply the time-honored custom of refusing to answer the bell as she may do when the house-to-house canvasser comes. However, it is a fact that telephone canvassing has grown to large proportions in some communities and may easily become a source of irritation. When it is done by legitimate business houses in a courteous way it seldom becomes objectionable, but the itinerant canvasser who comes to town and proceeds to call all of the numbers in the telephone directory is an unmitigated nuisance. Telephone companies are justified in taking any steps within their power to relieve their subscribers of this annoyance.

NOT TO BE READ TILL CHRISTMAS

Each year, we all do our part to relieve the burden of "the man in gray" by mailing our parcels early, marking them with the injunction: "Not to Be Opened Till Christmas." Some recipients of these parcels may have enough strength of character to refrain from peeping, but we fear that curiosity gets the better of many of us.

In the nature of things, we of the TELEPHONE ENGINEER staff also wish to send our Christmas greetings early; hence, the caption on this editorial. However, if you read it before Christmas, no harm will be done. You will know, all the sooner, that we are extending to all the circle of our readers our very best wishes for a merry Christmas and a happy and prosperous New Year.

BOOSTING MUTUAL LINE SERVICE

When managers of the smaller companies gather in district meeting, one of the many problems that come up for discussion is the difficulty of getting good service from farmer-owned lines which are connected to commercial exchanges. Every telephone man in the agricultural states is familiar with these lines; usually grounded lines strung on native poles and in more or less run-down condition. The users of such lines usually will explain that the service was very good when the line was new, but as it has grown older it does not work so well.

The reasons for this condition are evident to the experienced man, for he can see the places where insulation is poor, where the line is partially grounded on fences and trees, where there are poorly made joints and numberless other defects. Complaints of these conditions at district meetings often are made but seem to get nowhere toward remedying the situations. The manager harassed by trouble on lines with which he connects has little chance of improving conditions by telling his troubles to his fellow telephone men.

Occasionally, a manager will be found who has little complaint to make of the service on his mutual lines. When he does have reason to complain, he does it at a place where good will result. Such a manager has established contact with his rural patrons and has a way of getting them to put the necessary work on their line to keep it in good repair. He has assisted the farmer by making repairs on instruments; at a small charge, of course. He has demonstrated the proper way to make a joint in line wires and of connecting copper to iron wires, including the making of a good soldered joint. He has learned that it is almost impossible to get the farmer interested in doing much work on the telephone lines during the seasons of the year when farm work is pressing. He has learned that there are other seasons when work on the farm is

slack and it then is easier to get the men on the farm lines together to give their lines a general overhauling. In short, he has kept close enough to his patrons on the rural service lines that he has been able to get their co-operation and thus keep the service up to a point where satisfactory connections are the ordinary thing and not the exception.

WHAT ONE MAN CAN DO

In a section of the country, through which we have occasion to drive rather frequently, is a small town of a few hundred people. Taking the town with its surrounding farming country there is sufficient territory to support a telephone exchange of between three and four hundred stations. We have been observing this exchange over a period of two years and, from time to time, have noted the changes in the character of the telephone plant. Apparently, at the start, there had been two plants for a pole line with telephone wires on both sides of the main street, but all of the wires led into one office at the time we first began our observations.

Gradually, one of the lines began to disappear and new poles and cross arms appeared on the other line until, now, one of the lines has been removed throughout a greater portion of the town. In the country, there have been pole replacements and existing lines have been improved by pulling slack and straightening poles. All of the work has not been done just as we would have done it ourselves, but, in spite of a certain crudity it has resulted in a substantial improvement of the plant.

Our curiosity finally was aroused to the point where we began to make inquiries concerning the property and found that it had been acquired by an individual a few years ago after the consolidation of the two exchanges that had previously attempted to give service in the community. The owner had little telephone experience, but he started to work on the property and the changes we have noted are the result.

The money outlay to make the changes probably is not great in comparison to the results. The real secret of the situation is that the man who owns and operates the plant is a worker. We have come to know him and his habits better than he himself suspects as we drop into the office occasionally and our inquiry is met by the reply from the operator: "He is out on the line." Many times, as we have gone by, we have seen his Ford standing along the road and the man at work on the line.

Our observations and what we have learned in this case make us wonder what would happen in some of the dilapidated small town plants if men of real ambition got hold of them. The job of keeping out the trouble in the average small plant requires very few hours a week and station installations and changes are infrequent during a greater part of the year. A man who is not afraid to work and who can plan his work can make a remarkable showing in a few months' time if he would really devote the time he has available to the job of improving his property.

WHAT WILL HAPPEN, IF PRICES DECLINE?

In the decision of the United States Supreme Court in the Indianapolis Water Co.'s case, which was handed down recently, occurs a sentence that may cause speculation as to what may happen in case of changes in general price levels. Mr. Justice Butler, in delivering the opinion of the court, said: "It is well established that values of utility properties fluctuate, and that owners must bear the decline and are entitled to the increase."

With judicial decisions apparently giving more and more weight to "spot" reproduction costs, less depreciation as evidence of value, the question naturally arises as to what may happen if prices take a definite downward trend and become stabilized at a lower level than at present. While there is no present indication of such a trend, it is not beyond possibility and prudent utility managers must have such possibilities in mind.

A general decrease in price levels undoubtedly would bring a demand for a decrease in utility rates and, under the fluctuating value theory, the value of the property would decline and, in the words of the learned justice, "the owners must bear the decline." The effect of such a decline would be that commissions and courts would allow rates that would yield a smaller amount as a net return on the value of the property. In other words, fewer dollars would be available for distribution to stockholders and for surplus.

A conservatively financed property built up over a long period of both high and low price levels and with a capitalization well proportioned between owned and borrowed capital and surplus earnings probably would weather such a change without much difficulty, particularly as material and labor costs would decline with the general price levels. This would not be the case where properties have been purchased at present high prices and capitalized on the assumption that present earnings would be continued in the face of a decline in price levels. A reduction in the amount of net earnings might spell disaster. This is a possibility that may be worth serious consideration by those who are contemplating the purchase of telephone properties at some of the prices that have been reported to have been offered.

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The Laws of Direct Current Flow*

By F. J. DOMMERQUE

Fellow A. I. E. E.

39. Ohm's Law

In the discussion of the elements of telephone physics we had encountered Ohm's law in several forms. First in its purely theoretical aspect, when it was expressed as $I = \frac{(PD)}{R}$, which designates that the current is proportional directly to the potential difference and inversely to the resistance; at the same time it was stated that the transferrence of electrification—that is, the flow of the current—takes place under an electromotive force. Next, Ohm's law was stated in practical units as: $\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$ or, what is the same as: $\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$, which form corresponds to the theoretical expression given above.

Although this practical representation of Ohm's law is most illustrative, a shorter and more concise statement in algebraic form will prove handier for daily use, consequently it has become the rule to write Ohm's law as $I = \frac{E}{R}$, which symbolizes that the current equals the electromotive force divided by the resistance. Of course it is equally correct to write it $E = IR$ or $R = \frac{E}{I}$, as the second version can be obtained from the first one by multiplying both sides by R, and the third from the second by dividing both sides of the second equation by I. These expressions may be called the fundamental law of the flow of electricity.

As an extension of his fundamental law Ohm determined that the resistance of a circuit increases with increasing length of circuit, in which the current flows, and that the resistance of a circuit decreases with increasing cross section of the conductor.

We have designated the ohm, the ampere and the volt as practical units. As these units are of such importance in international science and trade, it became necessary to come to some agreement in regard to their value; that is, it was imperative to give to each unit a value which was to be binding for all countries.

The laws defining any physical quantity are based upon some known constant quantity. For instance the meter is the ten-millionth part of an earth-meridian quadrant. A standard meter is carefully held in safe keeping at Paris and at Berlin for reference. The laws defining the standards of electrical measure are the following:

"The unit of *resistance* shall be what is known as the international ohm, which is substantially equal to one thousand million units of resistance of the centimeter-gram-second system of electromagnetic units, and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice fourteen and four thousand five hundred and twenty-one ten-thousands grams in mass, of a constant cross-sectional area, and of the length of one hundred and six and three-tenths centimeters."

"The unit of *current* shall be what is known as the international ampere, which is one-tenth of the unit of current of the centimeter-gram-second system of electromagnetic units, and is the practical equivalent of the unvarying current, which, when passed through a solution of nitrate of silver in water, in accordance with standard specifications, deposits silver at the rate of one thousand, one hundred and eighteen millionths of a gram per second."

"The unit of *electromotive force* shall be what is known as the international volt, which is the electromotive force that, steadily applied to a conductor whose resistance is one international ohm, will produce a current of an international ampere, and is practically equivalent to one thousand fourteen hundred and thirty-fourths of the electromotive force between the poles or electrodes of the voltaic cell known as Clark's cell, at a temperature of fifteen degrees centigrade, and prepared in the manner described in standard specifications."

These definitions are not of importance for the practical telephone man. They show, however, how the national standardizing laboratories provide standards for use in practical measurements. It may be mentioned in conjunction with the Clark cell that it was the best standard available at the time the above definitions were agreed upon, but it has now been superseded by the Weston normal cell. The Clark cell had an electromotive force of 1.4325 international volts at 15° cent., while the newly adopted Weston cell has an e. m. f. of 1.0183 international volts at 20° cent.

Before enlarging any further on batteries a few examples are inserted to illustrate how Ohm's law is applied in practice.

In a magneto telephone the transmitter may have a resistance of 30 ohms and may be fed by a battery giving 3 volts; what would be the current flowing thrugh the transmitter?

By Ohm's law $I = \frac{E}{R}$, as $E = 3$ volts and $R = 30$ ohms, we have $I = \frac{3}{30}$ or $I = 0.1$ ampere. It is customary to say one milliampere instead of one-thousandth ampere; consequently one-tenth ampere would equal 100 milliamperes; therefore the answer to above example would be that the current would be 100 milliamperes.

Now suppose we had a common battery telephone with a transmitter of 300 ohms resistance, and the line resistance were 100 ohms, and we wanted a current of 60 milliamperes to flow through the transmitter, what would the battery voltage have to be?

60 milliamperes equal 0.060 amperes. By the second form of Ohm's law we have $E = IR = (300 + 100) \times 0.06 = 400 \times 0.06 = 24$ volts.

As an example of how to find the resistance when current and voltage are given, we may take a circuit wherein the resistance of the connecting wire is small in comparison to the apparatus. The current that is to flow in the circuit should be 5 milliamperes under a pressure of 6 volts. To effect this, what should be the resistance of the circuit?

This time we apply Ohm's law in the form $R = \frac{E}{I}$ and obtain $R = \frac{6}{0.005} = \frac{6000}{5} = 1200$ ohms.

40. Primary and Secondary or Storage Batteries

The Clark as well as the Weston cell is a primary cell of the wet type. In any primary cell chemical energy is converted into electrical energy. The simplest form of primary cell is made of a strip of copper and a strip of zinc, the two strips of metal being called the "electrodes." The copper and zinc are

*Ninth article on Telephone Mathematics and Physics.

immersed into a vessel containing a solution of water and sulphuric acid. The solution is termed the "electrolyte." Whenever the electrodes are connected by a conductor a current will flow whereby the electrodes are decomposed in the electrolyte. When all the electrode material is used, the current ceases to flow.

The two metals making up the electrodes do not need to be strips, they can take any form; in the wet type cell most commonly used in telephones of the earlier days the one electrode was a carbon block and the other electrode a zinc rod, the electrolyte was a sal ammoniac solution. Below is given a list of some of the materials which are used for electrodes. This list is so arranged that when any two of the substances or materials are taken to make the electrodes of, current will flow through a wire connecting these electrodes to the one appearing higher in the list from the one farther down. From this it is plain that the extreme upper end of each electrode, which protrudes out of the vessel and which is called the "pole," is a "positive" pole when it belongs to the substance lower in the list, and is a "negative" pole when it belongs to the substance higher in the list. The farther the substances selected as electrodes are apart in the list, the greater is the e. m. f. of the cell.

Zinc.
Cadmium.
Iron.
Nickel.
Lead.
Tin.
Copper.
Mercury.
Silver.
Platinum.
Carbon.

The difficulties arising when using simple cells like the one made up of carbon and zinc with a sal ammoniac solution as electrolyte (which is the Leclanche cell) are local action, polarization and internal resistance.

Local action is the wasting of the zinc when the cell is not in use. Zinc, that is, the commercial zinc, contains impurities; each foreign particle in the zinc in conjunction with adjoining zinc particles forms a diminutive cell on the surface of the zinc. Whenever a current flows in a cell the zinc rod will pass into solution and bubbles of gas will appear on the carbon or copper electrode; these bubbles are hydrogen. This is the case also with the tiny cells. But the current produced thereby is useless for practical purposes, whence the wastage of zinc. This wastage is called local action.

Polarization is caused by the film of gas bubbles deposited on the carbon or copper electrode when the cell is in action. This layer of hydrogen bubbles generates a voltage that opposes the voltage of the cell and diminishes the surfaces of contact between the electrode and the electrolyte, whereby the resistance is increased. Consequently voltage and current which the cell is capable to furnish are considerably reduced in a comparatively short time after the circuit is closed. Polarization may be prevented or greatly reduced by so-called "depolarizers," which may be solid or liquid chemical substances or gases.

The *internal resistance* of a cell with the external circuit resistance forms the total resistance of the circuit. The internal resistance depends on the kind of material used in the cell and the condition the cell is in. The lower the internal resistance, the larger the current, of course.

Nowadays the preference is given to dry cells in telephone work. The modern dry cell consists of carbon surrounded by a paste of manganese peroxide, carbon with some graphite to decrease the internal resistance, electrolyte and water. The mixtures vary with the different manufacturers. An average mixture is about as follows:

100 parts manganese peroxide
80 parts ground coke.
20 parts artificial graphite.
20 parts sal ammoniac.
7 parts zinc chloride.

The well-known Columbia dry cell has initial voltage of 1.5 volts and an amperage of 24 amperes or over. A good dry cell, however, should possess a liberal amount of electrolyte and zinc.

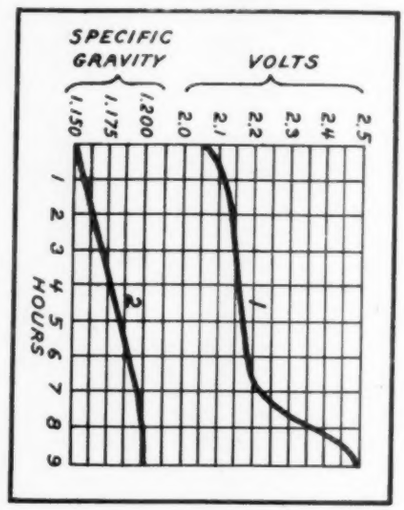

Fig. 41

Storage Battery cells differ from primary cells described above, since they may be discharged and then have their elements restored to normal condition to be discharged again and thus become a means of continuous storage for electrical energy. Small storage battery cells, such as are most appropriate for magneto exchange operation, contain two plates each, a positive plate and a negative plate. Larger cells contain an odd number of plates; there is always one more negative plate than there are positive plates, because the positive and negative plates are set alternately so that always one positive plate comes between two negative plates. There are different types of storage batteries, but the one preferred for telephone exchanges is the lead-plate battery.

The positive and negative plates differ

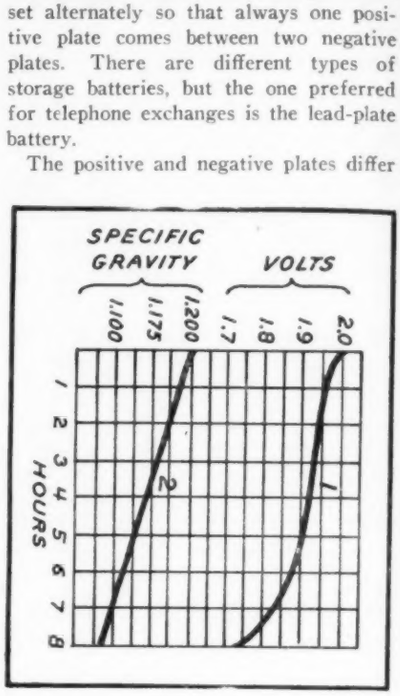

Fig. 42

in construction, though both are essentially lead plates. The positive plate in the most favored type carries the active material (peroxide of lead) in the form of buttons or squares, the negative plate is of a spongy lead. The electrolyte (1 part sulphuric acid to 9 parts distilled water) stands one-half inch above the plates in the cells, as per instructions of the manufacturers of the Chloride Accumulator, which instructions furnish also details as to charging and caretaking.

The electrolytic process going on in the storage battery is accompanied by formation of gases or fumes. In order to preserve other apparatus from becoming corroded by these fumes, it is essential to keep the cells covered with a glass plate and encase them.

The forming of the plates consists of a prolonged charge from a source of direct current, which oxidizes the plates intended for positives until the active material of the plate is transformed into lead peroxide, which has a brown appearance. The negative plates are reduced from the oxide condition of the paste to sponge lead of a grayish color. All positive plates are welded to a connecting bar and all negative plates to another bar. Each bar is provided with a connecting lug. If these bars are connected to a continuous or direct current supply and current is sent through the battery for a certain time, the current can be discharged and utilized after the source of charging current has been disconnected, but the discharge current has the opposite

direction from the charging current and flows only until the active material is used. By repeated charging and discharging the active coating becomes thicker and the capacity of the battery increases.

The capacity of a storage cell is usually expressed in terms of ampere-hours at a certain rate of discharge at normal temperature. If a cell is described as a 100 ampere-hour cell at a 5-hour discharge rate, it means that the battery will deliver 20 amperes for 5 hours, because the product of the hours and the amperes make the 100 ampere-hours. It is customary on the part of the manufacturer to specify the temperature and the voltage of the cell at the end of discharge. In above case he would state that the capacity of the cell is 100 ampere-hours at, say, 25° Cent. when delivering a normal discharge current of 20 amperes to a final voltage of 1.75 volts at end of discharge.

When a lead cell is being charged the voltage reaches in a few minutes 2.1 volts and at the end of charging 2.5 volts. The period of charging consumes

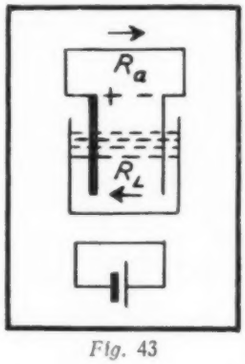

Fig. 43

from five to eight hours. During the latter part of charging the lead cells begin to gas freely; then it is advisable to decrease the charging rate and to stop it from time to time for short intervals. The manufacturer's instructions tell all about this. In Fig. 41 the upper curve marked 1 shows how the voltage increases with progressing charge, while the upper curve marked 1 in Fig. 42 indicates the decrease of the voltage during discharge.

Storage batteries must not be left standing in a state of discharge, because lead sulphate forms on both the positive and negative plates, which is hard and indissoluble. Lead sulphate forms also in the process of discharging. As the cell discharges, the specific gravity of the electrolyte decreases. Specific gravity is the ratio of the weight of a body, here the electrolyte, to the weight of water of equal volume. Commercial sulphuric acid has a specific gravity of 1.8; that is, it weighs 1.8 as much as water of the same volume. It is brought down by mixing with water to a little above 1.2. The electrolyte should be renewed when the specific gravity falls below 1.16. The specific gravity is determined with a hydrometer, which floats in the solution and is provided with a scale on the glass tube. The lower end of the tube is weighted so that it will float in upright position. The scale is read at the point where the hydrometer floats.

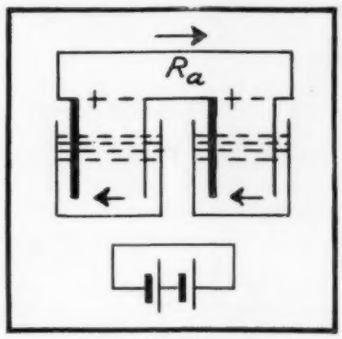

Fig. 44

In Fig. 41 and 42 the curves marked 2 give the increase of specific gravity during charging and the decrease during discharge respectively.

41. Series and Parallel Connections of Cells

In Fig. 43 a primary cell is indicated by a vessel containing as electrodes a carbon block and a zinc rod. The carbon block is the heavy drawn line and the zinc rod the thin line. These two lines may also represent any other pair of electrodes, but so chosen that the thick line corresponds to the positive electrode and the thin line to the negative electrode. In circuit drawings a cell is represented in a simplified manner as shown in Fig. 43 below the glass vessel. Of course the vessel contains also the electrolyte.

As soon as the two electrodes are connected by a wire, a current will commence to flow. The path of the current is from positive to negative pole in the external part of the circuit, the resistance of which may be designated by R_a, and from negative to positive electrode in the internal part of the circuit, the resistance of which may be R_i; the arrows indicate the direction of the current. The total resistance of the circuit may be designated by R; then $R = R_a + R_i$. The current is found by Ohm's law as $I = \frac{E}{R} = \frac{E}{R_a + R_i}$, and the e. m. f as $E = I\ (R_a + R_i) = IR_a + IR_i$, whence $E - IR_i = IR_a$. $E - IR_i$ or IR_a is the terminal voltage of the cell. Suppose the e. m. f. of a cell is 1.5 volts and its internal resistance is 0.25 ohms, and we connect the two electrodes by a short stout wire the resistance of which is so small that it is negligible, then the current flowing in the circuit will be $I = \frac{E}{R_i} = \frac{1.5}{0.25} = 6$ amperes. This means that all the e. m. f. is consumed in the cell.

Suppose we connect two cells as shown in Fig. 44 by joining the positive pole of one cell to the negative pole of the other. Then the total resistance of the circuit will be $R_a + 2R_i$, assuming, however, we connect the adjacent two inside poles by a short stout wire, the resistance of which can be neglected. It will be noticed that in this case the internal resistance is twice the resistance of the one before. The current is then $I = \frac{2E}{R} = \frac{2E}{R_a + 2R_i}$.

It must be remembered that after the current has passed the first cell the e. m. f. is repeated in the second cell, thus in this case the total e. m. f. is 2E; thus the terminal voltage at the two open poles is twice that of one cell, and also the internal resistance, but the current is the same. In the Fig. 44 below the two glass cells is added the conventional representation of the circuit. When two (or more) cells are connected so that the positive pole of one cell is joined to the negative pole of the one next to it, it is said the cells are connected in *"series."* Taking again the e. m. f. of each cell as 1.5 volts and the resistance of each cell as 0.25 ohms, and assuming the connecting wire between the two cells to have a negligible resistance, then the current flowing in the circuit this time

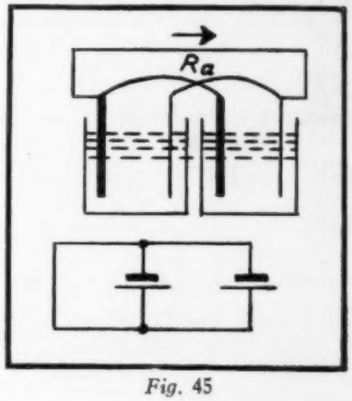

Fig. 45

will be $I = \frac{2E}{2R_i} = \frac{3}{0.5} = 6$ amperes the same as before.

If there were n cells in the battery instead of two connected in series we would obtain the current $I = \frac{nE}{R_a + nR_i}$ and $nE = I\ (R_a + nR_i)$, whence $E = \frac{I\ (R_a + nR_i)}{n}$.

We now connect the two cells as shown in Fig. 45 by joining the positive poles of the two cells together and also their negative poles. We then have really the equivalent of one cell with plates of twice the area and with twice the cross-section of the electrolyte; hence, as al-

ways, the resistance is inversely proportional to the cross-section of the conductor, we have only half the internal resistance; therefore, in this case, $I = \frac{E}{R_a + \frac{R_i}{2}}$.

Taking again the voltage of one cell as 1.5 volts and the internal resistance of each cell as 0.25 ohms, and the resistance of the connecting wires as negligible, the current would be $I = \frac{1.5}{\frac{0.25}{2}}$, neglecting the external resistance, or $I = \frac{1.5 \times 2}{0.25} = \frac{3}{0.25} = 12$ amperes.

This method of connecting the cells is called in *"parallel."* The general formula for n cells connected in parallel is $I = \frac{E}{R_a + \frac{R_i}{n}}$.

In the foregoing discussion we have made the external resistance negligible for the sake of easier explanation. In practice, however, the battery current has to perform work and the external resistance will amount to something.

Suppose we take our previous example and give to the external resistance the value 0.1 ohm. Then we would have in the case of the two cells in series $I = \frac{1.5 \times 2}{(0.25 \times 2) + 0.1} = \frac{3}{0.5 + 0.1} = \frac{3}{0.6} = 5$ amperes; and in the case of the two cells in parallel $I = \frac{1.5}{\frac{0.25}{2} + 0.1} = \frac{1.5 \times 2}{0.25 + 0.2} = \frac{3}{0.45} = 6.66$ amperes. For sake of comparison we will take the external resistance as 100 ohms; then with the two cells in series $I = \frac{1.5 \times 2}{(0.25 \times 2) + 100} = \frac{3}{100.5} = 0.03$ ampere (approximately), and in parallel connection $I = \frac{1.5}{\frac{0.25}{2} + 100} = \frac{1.5 \times 2}{0.25 + 200} = \frac{3}{200.25} = 0.015$ amperes.

Looking at the results of these four examples, it will be seen that in order to obtain as large a current as possible from a battery, it is advisable to connect the cells in parallel in case the external resistance of the circuit is small, and in series in case the external resistance is large.

There are cases of a mixed connection of cells, such as the one illustrated in Fig. 46. There are six cells in all, forming three pairs. The two cells in each pair are connected in parallel and then the three pairs in series. We know that, if a number of cells are connected in parallel the e. m. f. is the same as with one cell, and if the cells are in series, the e. m. f.'s are added. Consequently the

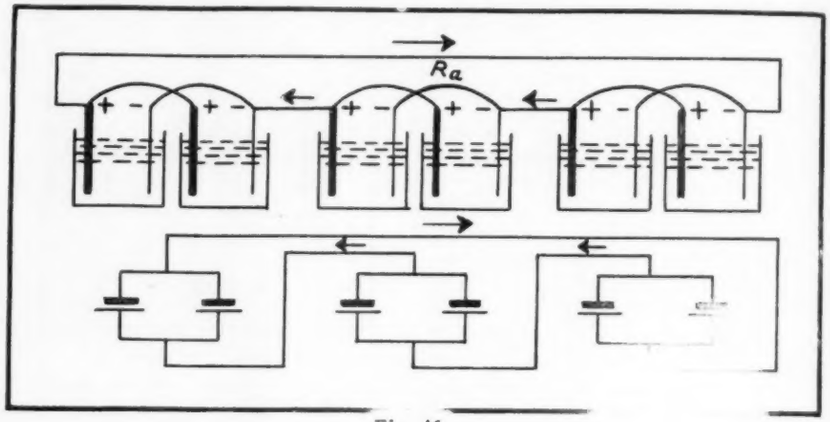

Fig. 46

e. m. f. of the circuit is 3E. We also know that with two cells in parallel the internal resistance is halved, hence the internal resistance of each pair is $\frac{R_i}{2}$ and of the three pairs $\frac{3}{2} R_i$. Thus we obtain $I = \frac{3E}{R_a + 3\frac{R_i}{2}}$.

As an example we take the voltage of each cell as 1.5 volts, the external resistance $R_a = 1$ ohm and the internal resistance as 2 ohms. Then $I = \frac{3 \times 1.5}{1 + 3 \times \frac{2}{2}} = \frac{4.5}{1 + 3} = \frac{4.5}{4} = 1.125$ amperes.

In general, if n cells having an e. m. f. of E volts each, are connected in series and the internal resistance of each of the cells is R_i ohms, the e. m. f. of the battery is n E and the internal resistance of the battery n R_i. If z batteries of n cells each are connected in parallel, the total internal resistance is $\frac{nR_i}{z}$. With an external resistance of R_a the total resistance of the circuit is $\frac{nR_i}{z} + R_a$ and $I = \frac{nE}{\frac{nR_i}{z} + R_a}$.

Here is an example: Given a battery of 20 cells arranged in two groups of 10 cells each. The cells to have an e. m. f. of 1.5 volts each and an internal resistance of $R_i = 0.2$ ohms each. The external resistance may be $R_a = 50$ ohms. Then by above formula $I = \frac{nE}{\frac{nR_i}{z} + R_a} = \frac{1.5 \times 10}{\frac{10 \times 0.2}{2} + 50} = \frac{15}{1 + 50} = \frac{15}{51} =$ close to 0.3 amperes. The current flowing in each one of the two groups is $\frac{I}{2} = \frac{0.3}{2} = 0.15$ amperes.

Here is another example still more illustrative. We wish to group the 20 cells of the previous example so as to obtain the largest possible current for an external resistance of 0.25 ohms.

This can be attained if we make the internal resistance equal to the external resistance, which will be the case if $R_a = \frac{nR_i}{z}$ or if $z = \frac{nR_i}{R_a}$, where z = number of groups of cells in parallel and n = number of cells in each group. As $nz = 20$ it will be $z = \frac{20}{n}$. From the condition that z must equal $\frac{nR_i}{R_a}$ we get $z = \frac{n \times 0.2}{0.25}$; but z is also $= \frac{20}{n}$, hence $\frac{20}{n} = \frac{0.2n}{0.25}$; by multiplying both sides of the expression by n we obtain $20 = \frac{0.2n^2}{0.25}$, and by multiplying both sides by 0.25 we obtain $0.2n^2 = 20 \times 0.25$. To determine n we divide 20×0.25 by 0.2 and extract the square root, thus $n = \sqrt{\frac{20 \times 0.25}{0.2}} = \sqrt{25} = 5$. To obtain the greatest possible current strength in the circuit it is therefore necessary to have in each group 5 cells; hence $z = \frac{20}{5} = 4$, or 4 groups of 5 cells each must be connected in parallel.

"Show Me" Is Keynote of Big Missouri Convention

Kansas City, Mo.—Public relations and collections were in the spotlight at the annual convention of the Missouri Telephone association which was attended by more than 300 of the state's telephone workers and a number of prominent operating and supply figures from beyond the Missouri boundaries.

Houck McHenry of Jefferson City was re-elected to the presidency of the organization. Other officials named at the Missouri session were: First vice-president, A. M. Benedict, Richards; second vice-president, S. D. Thompson, Cameron; third vice-president, G. W. Schweer, Clinton; fourth vice-president, W. N. Wicks, Willow Springs; treasurer, V. E. Chaney, Kansas City; and secretary, Robert W. Hedrick, Jefferson City. Mr. Wicks is the only new officer among the group.

The executive committee is made up of S. T. Neill, Clinton; M. L. Golladay, Holden; R. A. Guthrie, Macon; E. C. Blomeyer, Kansas City; H. C. Todd, Marysville; C. W. Boutin, Cape Girardeau; S. D. Thompson, Cameron; W. H. Bassett and C. A. Vedder, St. Louis.

An invocation by Rev. Charles A. Arnold and an address of welcome by Mayor Beach of Kansas City comprised the opening formalities of the meeting. Mayor Beach paid tribute to Theodore Gary as one of the leading builders of the western Missouri metropolis. Dr. S. T. Neill of Clinton responded to the address of welcome. Judge Thomas W. Alton, Kansas City spoke on "The Telephone from the Users' Viewpoint." He condemned the wrong number error as the most aggravating mistake in the user's opinion.

Judge Almoning of the Missouri Public Service Commission stressed the importance of the individual employee's actions in creating favorable public relations. Judge Ing told of the status of the telephone industry in Missouri, which consists of about 510 companies under commission jurisdiction and about 600 mutual companies not subject to commission regulation. There are about 20,000 persons engaged in the telephone industry in the state, 15,000 of them being women and girls. Each of these employees protentially is a builder or destroyer of good will for the company, the Judge pointed out. He defined the rights of the utility and of the public and lit into the glib old school politician and the yellow newspapers as the principal outside menaces to utility cordial public relations.

"The Construction and Maintenance of Small Telephone Plants" gave E. G. Gerber, divison plant superintendent of the Southwestern Bell force at Little Rock, Ark. an apportunity to deliver many practical suggestions to the conventioneers. Mr. Gerber went into detail about central office location, wire centers, types of offices and office equipment and construction and maintenance of outside plant. He told of the favorable influence of good looking, well lighted and permanent offices. He stated that in order for the substation portion of a plant to rate 100 per cent it should have but two troubles per 100 stations a month and called attention to the fact that but few of the plants were doing this well. With common battery boards three troubles per month per unit of 150 lines is allowable and with magneto boards 1½ troubles per month per unit is permissible in the well conducted plant, according to Gerber. For each mile of aerial cable, including the terminals, 0.9 of a trouble is allowable, for underground cable 0.56 of a trouble per mile a cable, including terminals and in open wire and drop wires the allowance is 0.1 for each single mile of wire, said the Southwestern man in establishing a standard by which the plant might be checked.

The concluding session was featured by a lively discussion on collections. The subject was introduced by P. Kerr Higgins, president of the Telephone Service Bureau, St. Louis. Mr. Higgins' address was on "The Keynote of Success—Prompt Collection Hints and Helps for the Smaller Companies." Mr. Higgins is qualified to speak on this subject as the companies he manages had from $2,000 to $8,000 on their books when he took charge. Today, due to the Higgins practices, the companies have about 128 per cent collections. Mr. Higgins advocated the exhibition of more backbone in collecting. He told his hearers to collect for three months in advance from all subscribers who had no credit standing in the community. He advised refusal of toll service unless the subscriber was willing and able to pay for it.

An address on "The A B C of Radio —Present Trends" which was written by Ray Manson, chief engineer for Stromberg-Carlson, was read by P. Winemiller of that company's staff in Mr. Manson's absence. A number of diagrams were shown and the principles of radio were explained clearly.

Missouri's state association is in good shape, having raised its dues last year and meeting with success in its efforts to have the state's companies make use of the association's help, according to the statement of Secretary R. W. Hedrick in his annual report. Mr. Hedrick went on record with the statement that 75 per cent of the state's telephone companies do not known their valuation within 50 per cent. He advocated immediate valuation of these properties by competent parties. C. C. Deering, secretary-treasurer of the U. S. I. T. A. spoke briefly on the toll operating correspondence course of the national association. Other prominent speakers were F. B. MacKinnon, president of the national association, Jay G: Mitchell, secretary-treasurer of the Illinois association and E. D. Glandon, president of the Independent Pioneer Telephone association.

An operator's conference, presided over by Miss Carrie Lee Thomas of Kansas City, was held during the meeting. Informal discussions made up the program.

The feature of the annual banquet at which 400 of the operating company representatives and exhibitors were present was a pageant, "Fifty Years of Telephone Progress," given by employees of the Southwestern Bell Telephone company.

Madison (Neb.) Property Bought by Continental

Lincoln, Neb.—All properties of the Madison (Neb.) Telephone Co. have been purchased by the Continental Telephone Co. of Lincoln for $83,000. In accordance with the Continental policy there will be no change in the local management of the Madison properties which had an executive personnel, prior to the transfer, of C. S. Snyder, pres., C. E. Pearson, sec.-treas., and Ed. Zessin, mgr.

This purchase gives the Continental a compact group of three companies operating in five contiguous counties, Nance, Boone, Platte, Madison and Antelope, in the best portion of northeastern Nebraska. Between 6,000 and 7,000 stations are on the list of these combined companies—the Madison, Platte county and Monroe telephone companies.

Stanton and Cuming counties, the home of two strong Independent and well-managed companies, adjoin this territory on the east, and the Northwestern Bell Company has a number of exchanges in still other counties, its division headquarters being at Norfolk, the largest city in Madison county.

George Cannon Heads Illinois Association—Annual Meet Is Lively

Springfield, Ill.—George X. Cannon of Freeport was named to succeed F. A. Norris of Monmouth as president of the Illinois Telephone Association at its annual meeting here. H. G. Lankford, Chicago, was named first vice-president and Louis Pitcher, Dixon, second vice-president. Mr. Cannon, Dr. J. G. Schwartz and W. S. Green were the new members elected to the board at the meeting which was attended by approximately 600 of the state's telephone men and women.

The convention overlooked no opportunity to get some business done as was evident when Dr. Schwartz, in replying to the complaint of nocturnal telephone distrubance made by Mayor Bullard of Springfield in his address of welcome suggested to His Honor that the mayor install an extension telephone at his bedside.

The retiring president, Fred Norris, in his address warned against ill-advised sales and consolidations and emphasized the necessity of teamwork on the part of telephone and electric properties in order that the present active extension of electric service in rural districts not interfere with telephone communication. The free-service evil and the aid that the association can give the smaller companies in making their accounting O. K. were other subjects mentioned in the presidential address. Group insurance as a reward of loyalty to those employees whose faithful service brings them into old age with a diminishing earning power and inadequate protection was suggested by the retiring executive as a matter calling for earnest and immedate consideration. He touched upon the supplying of wired radio programs and the furnishing of time service he condemned as a nuisance. Development of the association's plant engineering service also was detailed by Mr. Norris.

Jay G. Mitchell, secretary-treasurer of the association in his annual report advocated the formation of a representative committee of all the telephone interests of the state which could act with references to matters in the state legislature. Insurance, sale of companies, and publicity formed three of the feature topics in Mr. Mitchell's report. He spoke of the plan of furnishing member companies with advertising copy and cuts each week. This plan the association has under advisement. Mr. Mitchell told of the association's work in conducting district meetings, and of its work in bettering traffic work and transmission. He advised member companies to pay attention to the development of their toll revenue.

There has been a great change for the better in settling damage suits according to J. J. Nangle, vice-president of Lyton T. Block and Co. who spoke on "Experiences of the Claim Department." Mr. Nangle stated, "To the honest claimant who, by the negligence of the company has suffered injury or wrong, the present thought of our executives is to rectify it in a reasonable, fair and equitable manner through a money payment commensurate with the injuries sustained. Because of the difference of opinion that naturally arises upon the happening of an unfortunate accident, an account of the many elements that enter into the amount of settlement, the importance of skill attained by specialization in this phase of business life is apparent." He cited a number of cases of accidents that were but remotely probable in illustrating the lack of immunity to accidents, despite the oft-repeated statement of many telephone men that "accidents like that couldn't happen to us." He spoke of the legislative aspects of accident awards and expressed the belief that courts of arbitration for differences arising out of accidents would be established eventually.

One of the overlooked details with many companies is an ordinance passed by local authorities penalizing coin-box thefts. Cases were related of offenders being caught red-handed but escaping punishment due to lack of local laws covering these thefts.

It was apparent that the state association and the state university enjoy the benefits of close co-operation for two of the meeting's featured speakers were members of the University of Illinois staff. Dr. Horace M. Gray of the university department of economics spoke on "Some Economic Aspects of the Supply and Use of Telephone Service." He discussed costs from an economic point of view and explained the correct rate structure elements. Dr. E. R. Dellavou of the university, in his address on "Some Legal and Economic Principles Involved in Telephone Rate Making" bore heavily upon the efficiency of operation being closely associated with the rate of return. He told of methods of obtaining rates in Illinois, and gave some good advice concerning proper accounting methods. He reminded his audience that it was easier for a company to obtain rates when the public was with a company than when it was against it.

E. D. Glandon of Pittsfield introduced J. K. Johnston, secretary-treasurer of the Independent's Pioneer organization who spoke on the activities of this body, and then Mr. Glandon advanced into his set subject on "Wired Radio Broadcasting, A Logical By-Product of Telephone Service." He reviewed the present situation in this department of the industry, giving data on the character of installations and rates in his own situation, which has about 75 loud-speakers in service.

C. C. Deering, secretary-treasurer of the national Independent association related some of the work being done by that organization, and referred particularly to the accounting conferences and the toll correspondence courses, which have on enrollment of approximately 1,200 operators.

An interesting paper on "A Co-operative Plan of Insurance for Employees," was presented by W. C. Riddle, industrial engineer for the Travelers' Insurance Co. The address brought forth a spirited discussion and the meeting moved that group insurance be referred to the association's directorate for consideration.

Fireworks were touched off at the concluding session by Dr. C. L. Jones, Athens, Ohio, president of the Ohio Independent Telephone Association. Dr. Jones spoke on "Better Salaries for Managers" and put forth a great case on a delicate point. He showed that a manager who was well paid, and deservedly so, made the investment in his salary a very productive item for the company.

Tribute was paid in the resolutions passed by the meeting to the memory of three of its members who have died since the association's 1925 meeting. Manford Savage, thrice president of the state association, E. S. Starrett and E. D. Boynton.

Miss Pearl Thompson, formerly chief operator for the association, conducted an operator's conference during the convention.

The usual annual banquet and dance and a demonstration of the Vitaphone "talking movies," provided the entertainment for the convention.

There was the customary showing of the industry's leading manufacturers and supply houses made as one of the most interesting details of the session.

Geneseo, Ill.—Ill health has forced the resignation of Arthur E. Peterson as manager of the Geneseo Co-operative Telephone company. Max Wilke of Barry, Ill., now is managing the company.

United Telephone Company Formed as Independent Holding-Operating Unit

Chicago, Ill.—Following two years of preliminary work by J. G. Wray and Co., consulting engineers, and Wm. L. Ross and Co., investment bankers, both Chicago organizations, the United Telephone Co. has been formed. The United company has its headquarters in the First National Bank Bldg., Chicago. J. G. Wray and Co. will act as engineers and supervising managers for the company which will function as a holding and operation organization.

The United Telephone Co., a Delaware corporation, is a holding company with an initial authorized capitalization of 30,000 shares of first preferred stock with a dividend of $7 a share; 20,000 shares of second preferred participating stock with a dividend of $8 a share; and 25,000 shares of common stock of no par value. A bond issue, based on an open-end mortgage with conservative escrow provisions, will be created shortly. The bonds will be issued not to exceed 60 per cent of the property valuation.

Telephone properties have been acquired by this new holding company in Indiana, Michigan, Minnesota and Iowa. Other properties will be added as negotiations are concluded in these and adjacent states such as Ohio, Wisconsin and Illinois.

The properties acquired, it is stated, have been purchased on a conservative basis with the idea in mind of building them up and improving service to the public. It is intended to give the telephone companies acquired the advantages of management, supervision, centralized accounting, and engineering and financing assistance.

In practically every state in which the United Telephone Co. has acquired property, a subsidiary company will be the operating company, such as, for instance, the recently-organized Associated Telephone Co. in Indiana.

The new company is amply financed and those interested are firmly convinced of the desirability of and possibilities for a strong and successful group of Independent telephone properties.

Officers of the United Telephone Co. are: President, David E. Belden, St. Louis, president of the Community Power & Light Co., a public utility executive for 25 years; vice-president, Cyrus G. Hill, of Chicago, partner of J. G. Wray & Co., consulting engineers; treasurer, Herbert L. Nichols, of Chicago; and secretary, Fletcher Lewis, of Butler, Lamb, Foster & Pope, Chicago.

The directorate comprises the foregoing officers and E. J. Costigan, of Whitaker & Co., St. Louis; Fred W. Seymour, president, Federated Utilities, Inc., Battle Creek, Mich.; J. T. Walker, Jr., of Merrill, Oldham & Co., Boston, Mass.; William L. Ross of Wm. L. Ross & Co., Chicago, former treasurer of the old Cuyahoga Telephone Co., Cleveland, Ohio; and J. G. Wray of J. G. Wray & Co., Chicago.

Italy to Hold International Wire Congress

Washington, D. C.—Como, Italy, will be the venue of the International Telephone and Telegraph Congress, which is to be held during 1927 in connection with the celebration of the centenary of the death of Alessandro Volxta.

The Royal Italian Ministry of Communications, through the Italian Embassy at Washington, extends an invitation to interested institutions, firms and individuals in the United States to participate in the exposition and congress. All acceptances should be sent direct to the Royal Italian Ministry of Communications (Instituto superiore P. T. T.), Rome.

Grand Ledge, Mich.—The Webster Telephone Co. of Chicago and Muskegon has bought the Grand Ledge Telephone Co., subject to the approval of the utility commission.

Radio Program Men to Meet at Chicago

Kansas City, Mo.—Executive committee of the National Radio Program Service association, which was formed during the Independent Telephone convention at Chicago, met here November 18 and decided to hold the new organization's annual meeting at Chicago in January on a date that will not conflict with any state telephone convention.

It is expected that future conventions of the association will be held during the same week the U. S. I. T. A. meets.

Don A. Daso, P. O. Box 610, Jefferson City, Mo., is secretary-treasurer of the organization. Membership fee is $5.

"Isn't a Home Without a Telephone"—United

Abilene, Kan.—The United Telephone Company, taking a tip from the oriental proverb, "a picture says more than a thousand words," has compiled an interesting and effectively little booklet showing common incidents where lack of a telephone is a serious penalty to the conduct of human affairs today. There are humorous and serious situations illustrated with a touch of human interest that is bound to make even the casual reader pause, think and act. The style of the booklet's illustrations is shown by the accompanying illustration. The California Independent Telephone Association thought so well of the booklet that it sent a copy of the publication to each of its members and offered to make arrangements with the United company whereby California companies could buy copies from United, printed with the buying company's signature.

It isn't a Home Without a Telephone
"Better Phone May that Jr. is running away"
"She has no Phone"
Then May got her telephone!
"Let's Phone the Blacks to go with us-"
"But they have no phone"
Then the Blacks got a telephone!
And You Can Have One For a Few Cents a Day

Typical Pages from United Booklet

This board is carried in stock ready for immediate shipment in three sizes—50 line, 100 line and 150 line, with seven different equipment combinations in all. Write for Bulletin No. 71.

Better Superv n f

THIS Monarch Magneto ard, ha vision, provides the ope pany and efficient method of opera

The supervision offered w sign so designed that it can be u of th magneto boards, has many ges ov magneto supervision.

The clearing out signals in the are always visible. No long ey be of cords.

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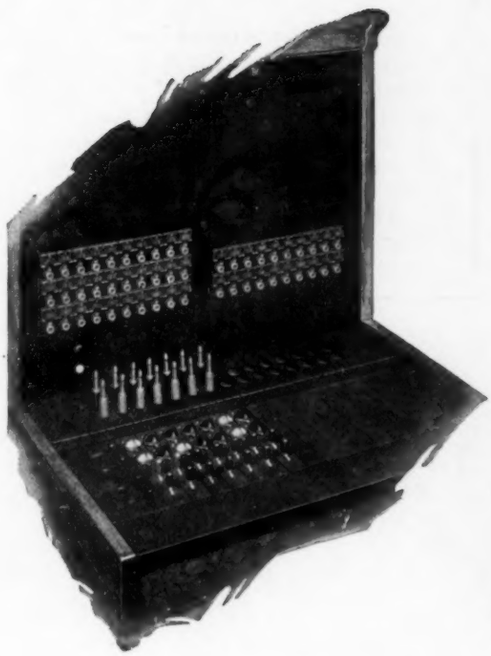

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Radio Products
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COPPER ON STEEL—MOLTEN WELDED TOGETHER

Non-rusting "COPPERWELD" is the *Only* two-metal wire that is molten-welded together as one metal.

Thus permanence and continuity of weld is definitely assured

"COPPERWELD"
Products Include
Line Wire
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Ground Wire Clamps
Cable Rings
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There never has been, nor is there now, any other "copper-covered steel" or "copper-clad steel" made like "COPPERWELD"—by the Molten Welding Process.

Sole **Maker**

In the manufacture of Copperweld no reliance is placed upon such mechanical adhesion as might be obtained by rolling and drawing. The weld uniting the copper to the steel is a molten one, made in a large ingot. Galvanic action cannot take place between the metals, due to this molten weld.

Briefly, the process is as follows:

A round steel billet 5 inches in diameter and 30 inches long is cleaned, fluxed and centered in a mold. A uniform space is left between the steel and the inner wall of the mold.

The mold is then sealed and placed in a furnace, where both are heated until the surface of the unoxidized steel is at its melting point. Molten copper is then poured into the mold, filling the space between the white-hot steel billet and the inner wall of the mold. This liquid copper coming into contact with the liquid surface of the steel forms an absolute and continuous weld.

Bending, twisting, hot-rolling, cold-drawing, forging or sudden temperature changes cannot destroy this molten weld.

The Copperweld ingot is then hot-rolled to a ⅜-inch rod, from which the wire is cold drawn, rolling and drawing as one metal.

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Through our many manufacturing connections we are able to buy the best quality and the "most dependable" construction Materials and Supplies.

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FOR THE INDEPENDENT TELEPHONE TRADE

Distributor of "COPPERWELD" Quality Products

BATTERIES (GG-2-12)

(Primary Batteries)

INSTALLATION AND CARE OF DRY BATTERIES. The performance and life of a dry battery is largely dependent upon the method of installation. The standard No. 6 dry cells should always stand vertically so that the carbon electrode will remain central. Laying the cells on their sides always shortens the life of the cells because of the gradual displacement of the carbon rod due to its weight. The sealing wax used as the upper support of the carbon is really a semi-fluid which gradually flows under the twisting moment of a horizontal carbon and in this way the rod may short circuit or the wax may be so displaced that the can is uncovered and moisture loss takes place through the opening.

Location has much to do with the life, a hot, dry place hastening the evaporation of the cells and accelerating the chemical action which leads to wasteful local currents. Damp locations frequently cause trouble by corrosion taking place on the terminals, or high resistance grounds or short circuits through which the energy of the cells is gradually frittered away. Damp paper jackets with the sides of the cells in contact provides a leakage path which will rapidly shorten the useful life of the cells when connected either in series or parallel. It is always best to slightly separate adjacent cells by means of a thin non-absorptive strip to insure freedom from body contact losses.

Wire connections to the cells must be carefully made to eliminate the possibility of open circuits or short circuits and the connections should preferably be made with stranded rubber insulated wire such as No. 18 fixture wire. When connecting the individual cells in series or parallel, the interconnections should be bent carefully so that the wire will not make contact with the edge of the zinc can and thus cause inter-cell short circuits. This may sound elementary, but it is still a frequent source of trouble just the same. The wires should be as short as possible between cells without causing a strain on the wire, leaving enough slack so that it can be bent up at the point where it crosses the zinc.

Spring connectors are desirable means of making connections to the cells, for they grasp the wire firmly and cannot be slacked off by vibration. For the standard binding post type of connector it is highly desirable to use short rubber covered connectors provided with a soldered connection lug at each end. The lug cannot be displaced even though the binding screw does loosen up, and while the circuit may be opened by the loosening of the screw, yet the wire cannot get free and cause a short circuit between the cells.

Corrosion at the points of connection can be prevented by greasing the bare ends and the connector with just a trace of vaseline, and tinned wire is always advisable for making such connections. With eye connectors, stranded flexible wire is preferable to the stiff solid wires sometimes used, particularly with binding posts, for there is little tendency to loosen the posts with the flexible wire.

BATTERIES (GG-2-13)

(Primary Batteries)

DATING CELLS. The date of installation should be marked on each cell and a corresponding record should be made in the subscriber's ledger as a check-up on the battery current used by the subscribers. Unless specially provided for by means of a lock-out battery saver, an inquisitive "listener-in" may waste a great deal of battery current and run up the expense rapidly. The battery lock-out when installed in such positions enables the subscriber to listen in but maintains an open circuit in his battery line until he presses a button which releases the receiver hook and thus enables him to carry on a conversation. The expense of such a lock-out is relatively small and its use affects a great saving in batteries in certain locations.

RENEWING BATTERIES. The "cut-off point" at which the cells must be replaced averages approximately 0.9 volts per cell in most localities, and many of the telephone commissions have set this as the absolute minimum to which the discharge can be carried. The minimum for long distance work is 2.8 volts total for three cells in series, which is slightly over 0.9 volts per cell. Of course this applies to the voltage of the battery due to the normal drop in service and without recharging methods sometimes resorted to.

Recharging a dry cell is possible but far from practicable. Many formulas will be found in technical papers from time to time which show how batteries can be recharged economically, but in all cases they fail to explain how the zinc can be replaced. Adding vinegar or acid to the battery through a hole punched in the tops of the cells is simply a waste of time and money, although nearly everyone at some time in his life attempts this salvage operation.

In testing cells a reliable voltmeter should be used with a scale not exceeding three volts so that the voltmeter needle will stand at the most accurate central portion of the scale with normal cells. Ammeter readings, so commonly made on ignition dry cells, have no place in testing of telephone batteries. The drain on the telephone battery is far lighter than that on the ignition cell and therefore the output in amperes has little to do with the subject. Each cell in a group should be tested separately for voltage. If only one cell is low and the installation is comparatively new, the low battery can be placed by a new cell, but it is never advisable to place a new cell in series with an old low voltage cell. The high resistance of the old cell, its tendency toward causing noise, and the fact that the total voltage soon drops and calls for more attention, makes such practice a time and money wasting proposition.

Under normal conditions of operation and installation, a good standard dry cell should have life of about ten months in service.

Old batteries can be used for switchboard night alarms, door-bells, buzzers or a number of similar purposes after they have been discarded for subscriber service, and will last for quite a long time on such intermittent work.

BATTERIES (GG-2-14)

(Primary Batteries)

DRY BATTERY TESTING. Testing new batteries for their economical life in terms of cents per hour of service is an essential part of the program to be followed by a telephone company. Such tests should only be made under fixed known conditions at the plant or storeroom, as the service conditions are so varied that a test at the subscriber's installation is entirely impracticable. All battery tests are by nature comparative and therefore comparisons should be made under constant standard conditions. The methods are simple and the instruments required are inexpensive so that there is no real reason why such work should not be carried out by the smallest exchanges.

The useful service rendered by a battery is the number of hours on heavy service delivered down to the "cut-off" voltage of 0.9 volts per cell. After this has been determined the cost of operation per cell can be found by adding the cost of the cell to the freights, drayage and installation costs, and then dividing the total cost by the number of hours down to the cut-off point as shown by test. As there are at least four variables concerned in this determination, considerable study will be required to determine the controlling factor with any particular make of battery. The initial cost of the cell may be the controlling factor under some conditions while the life and cost of installation are contrary factors contributing against the use of a cheap, short lived battery.

Short lived batteries increase the number of installations per unit of time and if labor is expensive and transportation difficult, the cost of the cell may be secondary to the installation expense. With short lines, cheap labor, and similar conditions, the cost of the cells becomes a more important item. Freight charges, cost of unpacking and handling, storage, shortages and loss, and similar items must be added to the net initial cost of the cell to obtain the total cost.

To test cells under actual service conditions would require too much time before they dropped to the cut-off point, therefore the "accelerated test" is employed, which attains nearly equivalent results within a few weeks' time and with but little error. The rate of current flow is considerably greater with the accelerated test than in service, but repeated comparisons have shown that the results thus obtained will be proportional to the standard tests proposed by the U. S. Bureau of Standards. The latter test requires quite elaborate equipment and is only suitable for large companies maintaining testing laboratories.

CELL GROUPINGS. Commercial dry batteries can be had in single units, casings of two cells (3 volts), casings of three cells (4.5 volts), or the radio "B" batteries of 22.5 volts and 45 volts respectively. Such cell groups or "units" are generally series connections to obtain a voltage equal to the cell voltage multiplied by the voltage per cell.

BATTERIES (GG-2-15)

(Primary Batteries)

RADIO "A" BATTERIES. The No. 6 standard dry battery is used for heating the filaments of certain radio tubes, special tubes having been devised particularly for dry cell operation. The most important of the dry cell radio tubes are the WD-11, WD-12 and UX-199 tubes having the following characteristics:

Type of tube.	Filament volts.	Battery volts.	No. cells in series.	Resistance rheostat.	Current in amps. per tube.
WD-11	1.2	1.5	1	6 ohms	0.25 amps.
WD-12	1.2	1.5	1	6 ohms	0.25 amps.
UX-199	3.8	4.5	3	30 ohms	0.06 amps.
UX-201A	5.0	6.0	4	15 ohms	0.25 amps.
UX-120	3.8	4.5	3	25 ohms	0.12 amps.

As the filaments of the radio tubes are generally connected in parallel for battery operation, the addition of a tube increases the total battery current by the amount given above. Except for the type of base and mounting, the WD-11 is identical with the WD-12. The UX-201A tube is primarily intended for storage battery operation, but one or two of these tubes can also be operated economically on dry batteries so long as the demand per cell is not greater than 0.25 ampere. For vacuum tube filament service, the batteries must be grouped so that not more than 0.25 ampere flows through each cell. A higher rate of discharge causes the voltage to drop through polarization and exhausts the cells rapidly.

The UX-199 tube is probably the better tube to use with dry batteries when the radio set contains more than two tubes. They are good radio frequency amplifiers, fair audio frequency amplifier and a good detector. As they require only 0.06 ampere per tube, a four or five-tube set can be operated from a simple series of three dry cells in series. The UX-120 tube is a last stage audio tube intended for use with the UX-199 tubes and takes twice the current. It gives greater amplification and better tone with six to ten-tube sets. A set of cells will give good service at a discharge rate of 0.25 ampere or less, and will last several months under ordinary conditions of service.

When the demand is greater than 0.25 ampere per cell, then two or more series groups can be connected up in parallel. In making such parallel connections, it is important that all of the cells be of one size, type and make to prevent the circulation of local idle currents. A three-way switch connected so that the cells are cut out of parallel when the tubes are out of circuit will do much to prolong the life of the battery.

Charles North, Veteran Independent Genius, Dies

Cleveland, O.—On November 24, 1926, one of the outstanding pioneers of the telephone industry, Mr. Charles H. North, passed away at his home here. "Charlie" North had been continuously engaged in this industry for a period of forty-five years.

Mr. North was born at Columbia, Ohio, of Connecticut Yankee parentage, April 14, 1860. He received his higher education at Oberlin College during the years 1875 to 1879, after which he taught school at Greenwich, Ohio, until early in 1881.

In the Spring of 1881 Mr. North first engaged in construction work for the newly organized Akron-Canton and Massillon Telephone Co., and continued with this company until the construction work was completed, when he became associated with the Cleveland Telephone Co. In 1884 Mr. North began the manufacture of telephone equipment and continued in this work from that date until his death. During the past few years his activities were somewhat limited by his health, but he maintained his interest to the last, having attended the last National Convention of the U. S. Independent Telephone Association in Chicago in October and an Ohio district meeting held at Ashtabula, Ohio, recently.

Mr. North contributed many useful improvements in telephone apparatus and in the methods for manufacturing. The receiver with enclosed terminals is one of his most outstanding improvements in telephones. His work in connection with the common battery multiple switchboards contributed much to the success of many independent telephone companies in their earlier days. Mr. North, a true pioneer, was always on the frontier of development in the telephone industry; as early as 1904 his activities were directed to machine switching systems, particularly the automanual system. His work in the design of selector switches and relays, which has been one of the outstanding developments of modern telephony, was done with the thoroughness that characterized his early work on manual equipment. Mr. North was a man who zealously guarded his integrity and who reflected his character in the apparatus that he designed and built.

He was always identified with the Independent group and until recent years has been active in its affairs. His many friends will be greatly grieved to learn of his death, and the industry in general will miss this much respected pioneer.

At the time of his death Mr. North was a director of The North Electric Manufacturing Company of Galion, Ohio, the company which he founded in 1884. He was a member of high degree in the Masonic order.

Review of Recent Publications on Telephony and Allied Subjects

Safety Rules for the Operation of Electrical Equipment and Lines. Handbook of the Bureau of Standards, No. 8. Government Printing Office, Washington, D. C.

Heretofore the rules of the National Electrical Safety Code have been published in complete form, but there has been some demand for separate portions, and as a result the publication is now being made by sections as well as by the complete code. The present handbook, which contains section 4 of the code, relates to the rules for safety in operation of electrical equipment. It does not deal with safety rules applying to new construction not yet energized. The sections that will be of most interest to telephone men are sections 44 and 45, giving rules for employes of communication systems. The rules of sections 450, 451 and 452 should be thoroughly understood in substance at least by every man who has to do work on telephone lines and the complete handbook should be placed in the possession of every foreman and supervisory employe. Copies may be secured from the Superintendent of Documents, Government Printing Office, for fifteen cents each. As in the case of other government publications stamps will not be accepted in payment.

Golladay Made General Mgr. of Middle States Utilities

Holden, Mo.—Dr. M. L. Golladay, general manager of the Central Missouri Home Telephone Co., has been named general manager of the Middle States Utilities Co., owners of 40 telephone exchanges in Missouri and southern Iowa.

Wants Data on Comparative Merit of Wires

From several sources TELEPHONE ENGINEER has had requests for information on the comparative merits of copper and iron wire. This subject could be threshed out in print for the profit of all concerned, and we invite readers to submit stories of experiences, observations and beliefs.

THE CONVENTION SCHEDULE

SOUTH DAKOTA
Sioux Falls, January 13, 14 and 15, 1927.

MINNESOTA
Saint Paul, January 25-27.

NORTH DAKOTA
March 8, 9 and 10, 1927.

NEBRASKA
Lincoln, Lincoln Hotel, February 15, 16 and 17, 1927.

KANSAS
Manhattan, April 5, 6 and 7, 1927.

Paris Orders Automatic "Rotary System" Telephones

The International Telephone and Telegraph Corp. announces an order for the construction and installation of 40,000 lines of Automatic Telephone Exchange equipment to be installed in Paris.

The system is the "Rotary System," similar to the power driven automatic system installed by the Bell companies in the large metropolitan areas in the United States, such as New York, Philadelphia and Chicago. The entire equipment will be manufactured in France by French engineers and workmen. In addition to other important cities, the "Rotary System" has been adopted by the following European capitals: Brussels, Budapest, Bucharest, Copenhagen, The Hague, Madrid and Oslo.

Bell Employe Roster Doubles Each Decade

New York City—During the summer of 1926, the number of employes in the Bell System passed the 300,000 mark. The number of employes has almost doubled in each of the last two decades, and it is estimated that if the present rate of growth is maintained during the next ten years, there will be over half a million employes in the system by 1936.

C. L. Brown, president of the United Companies, Abilene, Kans., has created a $100,000 charitable organization, known as the Brown Memorial Foundation, a tribute to Mr. Brown's parents, Jacob and Mary Brown. It will care for the aged, or oruhans, for widows and unfortunate girls, and will lend money to educate poor children.

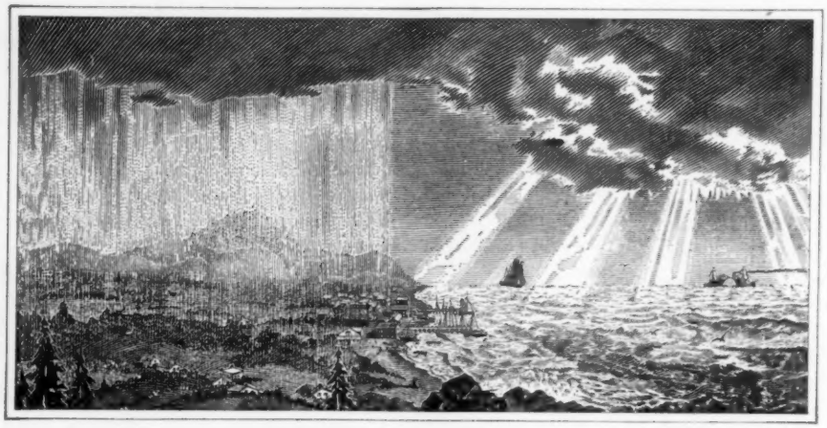
L. M. Harrington, manager of The Town & Country Telephone Co. at Canby, Minn., has been appointed district superintendent of the Dakota Public Service Co. which recently purchased that company's exchanges and other properties in eastern South Dakota.

Mr. Harrington will supervise about a dozen exchanges with headquarters at Canby.

Frank V. Newman, for more than seven years general manager of the La Porte Telephone Co., La Porte, Ind., has tendered his resignation to the board of directors of the company to take effect January 1, when he will become general manager of the Commercial Telephone Co. of Lawrenceville, Ill.

The next annual convention of the Minnesota Telephone Association will be held at the St. Francis Hotel, St. Paul, January 25-27.

George H. Carter, for 20 years general manager of the Citizen's Telephone Co., Delaware, O., died November 29.



Rain and Telephone Calls

THE annual rain fall in the United States would weigh over three and one-half trillions of tons.

This vast weight is drawn up to the clouds by the unseen but effective power of the sun; representing energy equivalent to 300 billion horse-power.

The annual telephone conversations total over twenty-five billion a year. As silently as sunlight, electricity, mastered by the human mind, carries the voices of the nation.

There must be the man-power of 300,000 individuals to build, maintain and operate the telephone system.

There must be the money-power of over seven hundred million dollars a year to pay for operating the plant, in addition to three billion dollars invested in the plant.

The rain sustains life; the telephone furnishes swift communication for the nation, and they are alike in requiring a vast amount of unseen energy.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

BELL SYSTEM

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

Financing Fundamentals That Control Bargaining for Capital*

By HERBERT B. DORAU

(Assistant Professor of Economics in Northwestern University School of Commerce)

Financing is the bargaining for capital. In a growing industry this is almost a continuous process. The nature of the financial bargains which the telephone industry makes has most definite and far-reaching results upon the way in which this industry in whole or in part will be able to meet its public responsibilities.

It is important in the first instance because the capital factor in the telephone, as in other public service corporations, plays relatively a very important part. The capital turnover in the telephone utility is very slow, being about once in four years. When capital works slowly and has much to do, a great deal of it is needed. The proportion of revenue needed to provide the return on capital is large when compared with undertakings in which the turnover is frequent.

To illustrate the significance of the annual demand for capital which the telephone industry makes, I refer to an analysis recently made for our institute which shows that the telephone and telegraph industry was responsible for over a billion and a half of par value of new security issued during the last six years. This figure does not include some substantial amount of small issues which because of their size never appeared in the markets.

Since 1921 the annual volume of telephone financing has been between 200 and 300 million dollars. During the first six months of 1926 alone, the volume exceeded 200 million dollars par value. This represented, even in years of tremendous public utility financing, a considerable proportion of all utility issues ranging from 16 per cent to 30 per cent of the total for all utilities excluding steam railways.

More specifically, financial practices and policies affect the *supply* of capital and the *price* at which the necessary supply is obtainable. Financial practices which make for an increased price of capital or even make it difficult, or impossible to get the capital needed at all, affect the ability of a public service corporation to perform its duties in a very definite way. Since capital holds a place of such importance in this industry, the cost of capital is an important element in the cost of the service to the consumer.

The company, which so arranges its affairs and conducts itself so that it can secure an adequate supply of capital at low cost, is in a position to: (1) most perfectly meet the spirit and letter of its duty to serve at a reasonable cost; and (2) also to reap a business profit.

Financing Factors.

The difficulties of obtaining capital sometimes have developed to such an extent that the price which would have to be paid is prohibitive, in that it is greater than the return per cent received on the existing investment. Inability to get capital at rates below the rate of return is, for practical purposes, the same as not being able to attract capital at all.

A management in such circumstances is doubly distressed. It finds itself unable to meet the public demand for enlarged or improved facilities and thus fails to meet its public responsibilities. It is unable to take advantage of a better market for its services with profit.

Inability to command capital on a par with other industries affects the cost and the quality of the service rendered. This is a consideration of fundamental importance to the industries.

Credit may be defined as the power to command capital at favorable prices. It has been pointed out that the public service corporation which has poor credit can not fully meet its obligations to the public nor make a satisfactory business profit. The borrowing power of a public service industry, such as the telephone industry, is determined by a variety of conditions and circumstances. They may however be grouped into two classes: (1) Those for which the public is responsible and which are out of control of the industry; and (2) Those over which management of the industry has control and for which it is responsible.

There may be mentioned—among the conditions for which the public is responsible and which have an adverse effect on credit and thus on the cost and adequacy of service—regulation which by its stringency retards rather than fosters growth, frightens capital away rather than attracting it as a proper system of regulation should; there is the result of term franchises, and the effect of competition of tax-exempt securities with the taxable securities of essential industries. These and other conditions are the responsibility of the public.

The most important single condition affecting credit, over which the industry has control, is the character of the financial structure. This has two aspects—the amount of the outstanding securities upon which investors expect a return, and the character of these obligations. Thus the capitalization of a public service corporation may be improper in quantity and in quality.

Discussion of capitalization of public service corporations in the past has emphasized the evil of excess quantity of securities outstanding in relation to the value of used and useful property—and this is a fundamental consideration in telephone utility finance.

A company with too heavy a capital structure will experience difficulty in paying interest and dividends. It will be tempted to pay out, in the form of dividends and interest, earnings which should go toward maintenance and the provision for depreciation. Management of concerns, hard-pressed in this way to satisfy the expectations of investors, seek rate increases to the limit of their rights—and it is only natural that they should do so.

The result of this sort of demand for rate increases has, and will have, serious effects upon the public attitude. Financial practices through their effect upon rates, quality and adequacy of service are at the bottom of many difficult public relations situations.

The other aspect of capitalization—namely, that of quality or structure—has not received the attention that its importance would justify. Whether a concern is over-capitalized is a matter of greater or lesser importance, depending upon the character of the securities issued and to whom issued. An over-issue of common stock closely held is not of the same concern as an over-issue of bonds.

The issues of preferred stock on a customer or employe ownership basis is, in this connection, a serious problem.

Many public service concerns have succeeded in maintaining a fairly satisfactory ratio of debt to total capitalization but have issued an inordinate volume of preferred stock to customers. Dividends upon preferred stock sold to customers and employes can not but be later treated as a quasi fixed charge—a payment which does not legally have to be made but

Address delivered at annual convention of United States Independent Telephone Association.

which every management will feel almost under a legal compulsion to continue to make.

Customer-Owner Obligations.

The class of investors to whom customer shares have been sold can not and should not assume the business risks of the industry. The customer ownership movement has done a remarkable thing for the public service industries, but the customer-owned preferred stock must, for many purposes, be looked upon as is the debt capitalization. Its volume should be related to the amount of earning equity back of the common stock, not to the total capitalization. Any financial practice which unduly reduces the amount which the owners have at stake is dangerous.

Another aspect of customer ownership financing, to which attention should be given, is the fact that it is more and more being adopted by the weaker units in these industries. For the good of the movement and the industry, it would be well if it were recognized that the typical customer-investor is not a proper risk-taker and that, as the risk factor increases, the propriety of customer financing decreases. It would be conservative of the greatest possibilities of customer ownership, if only the stronger concerns invited their customers to become partners.

The credit of any industry, and any unit in that industry, is seriously affected by the record which that industry or unit has made in meeting its obligations. The telephone industry has a splendid record to uphold. Telephone securities were never in a better relative position than they are now.

Studies[1] made by the Institute for Research in Land Economics and Public Utilities show that new telephone security issues have, during the last six years, been offered at rates lower than public utility securities in general, and at lower yields on the average than any other utility, excepting only the water utility. Figures set forth in a table show that the the telephone industry has consistently borrowed capital at rates a quarter to three-quarters of a percent lower than the average for other classes of utilities.

Almost nothing could do more to ruin this exceptional standing of telephone securities than the disappointment of any numbers of customer owners. The really serious aspect of the problem for the industry at large is that the action of any one or a few concerns has a harmful effect on all and all out of proportion to the relative significance of the concerns involved.

The typical investor buys securities on advice and faith. Just as now public utility securities are exceptionally popular, the day can come when, instead of accepting them as a class, the investor will in the same manner reject them as a class.

While there are individual cases of distressing practices, to which the officers and members of this association have brought attention, these appear to be merely dangerous exceptions. There has been very little fundamental change in the capital structure of the non-Bell telephone companies during the last 20 years.

Debt Ratio Given.

Reports of the Bureau of the Census show the ratio of debt to total capitalization to have remained comparatively constant and lower in 1922 (35.6 per cent) than in any year except 1907. The ratio of debt to total capitalization of the Class A company members of this association has remained practically constant from 1916 to 1924, in which year this ratio stood at 42.07. The Class B and C member companies actually show a decline in the ratio of debt to total from 33.5 per cent in 1916 to 25.6 per cent in 1924.[1]

Reference was made earlier to the volume of telephone financing. It should be further noted here that the proportion of financing by the sale of stock in the case of the telephone and telegraph utilities far exceeds that of other utilities. Whereas the telegraph and telephone utilities accounted for about 20 per cent of all issues during the last six years, they nevertheless were responsible for over 40 per cent of the par value of stock issued.

Economic historians will refer to the past few years as an era of consolidation in the public service industries. During the period 1898 to 1903, a similar combination movement took place involving a number of our basic non-utility industries.

The results of these consolidations, careful students tell us, were not always up to expectations, and in not a few cases disastrous.

The Merger Mania.

Such movements, however, normally have a real foundation in the economies which some can obtain, but the few, making a conspicuous success, will be imitated by others. Soon there develops a sort of boom psychology which sweeps with it all but the most conservative.

The electric light and power industry has and is experiencing a most rapid reorganization into larger units through the device of financial marginal consolidation and operating co-operation by interconnection. The economic basis and desirability of consolidation in this industry is apparent even to the layman. But even there, leaders in the industry are calling a warning and pointing out that consolidation with its incidental refinancing are means to achieve certain economies and not ends in themselves.

All students of the telephone industry believe that a progressive movement toward more closely-knit organizations is a step in the right direction. It must, however, be remembered that consolidation here also is only a means and not a justifiable end in itself. There is no innate economy in large size. Large size always brings with it additional expenses. When, as, and if the economies of consolidation exceed the expenses to be incurred now and in the future, the economic basis for combination exists.

But operating and managerial economies have a basis in the technology of the industry. They can not be promoted into existence where they do not exist. The telephone industry is not a parallel to the electric industry for unlike it, there are no great gains to be made from tying together a few small plants.

Any attempt at capitalizing such gains through consolidations and the establishment of complicated over-sized capital structures can not but harm an industry that has much to lose. It should be furthermore noted that our leading commissions, while giving assent to sales of properties at prices beyond their present value, have nevertheless issued warnings that assent to such sale in no way meant that these sales prices would be given any recognition as a basis of value for rates.

The problems of our public service industries in the past have been largely technical. The important problems of the present and the future are economic and financial.

Polk City, Fla.—Telephone service will be available to Polk City soon. Poles for a line from Auburndale to Polk City have been set.

A good sized manual telephone switchboard contains a million soldered connections.

The average American makes as many telephone calls in six weeks as the average Englishman does in a year.

From a telephone standpoint, France is no better developed than is the Island of Cuba, as both have but 1.7 telephones per hundred inhabitants.

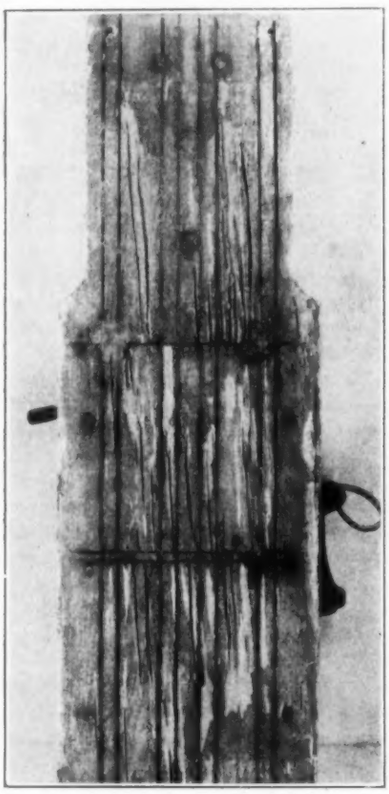
WANTED—Position as Manager of exchange of 1,000 to 2,000 subscribers. Have had adequate experience with magneto systems, which includes line, cable and switchboard work—and most important of all—collecting. Have had high school and 2 years college education. Write or call Byron M. Skelton, care Port Byron Tel. Co., Port Byron, Ill.

[1] *See the Journal of Land and Public Utility Economics, July 1925.—A. W. Shaw Co., Chicago.*

LINE AND DESK

BUGS WE HAVE SHOT: ANTS IN THE TELEPHONE.

The accompanying photograph shows a wall type, magneto, telephone which was reported noisy. An inspection revealed the fact that white ants of the species common here in the Philippines had bored up through the wall of the building, through the backboard of the set and were inside the



Ants Wrecked This Telephone

instrument by the thousands. The insulation of the greater part of the wiring was completely eaten away. These ants always work up through the wood from the ground and never come to the surface as they can live but a short time when exposed to the light. They are very destructive to all soft wood and sometimes a building, apparently good from the outside, will crumble due to ants eating the supporting timbers away and leaving just the outer shell. In the old Spanish days all buildings were built with stone and native hard wood which were not affected by ants, earthquakes or time, as some are still in almost perfect state of repair after nearly 200 years. But what is bothering me is, why these ants picked that poor old magneto telephone for a home.—Ray Blain.

TECHNICAL EXPERTS.

The following quotation is taken from Clemenceau's letter on the subject of the French debts to this country incurred during and after the War:

"On each side technical experts in finance are at work. A technician is too often a man whose pleasure consists in isolating his own problem from those which he is occupied in co-ordinating.

"Everything in public affairs contributes to form a whole, and anyone who thinks he can isolate himself in his own domain is running the risk of finding himself overwhelmed later when it is too late to mend matters."

While the experts referred to are financial, the remark is worthy of consideration by all experts. The tendency referred to is one against which we should all of us at all times be on our guard. The technical expert must watch himself not only in the solution of his problem, but also in its formulation, to see that he does not either eliminate or ignore important factors, merely because they are non-technical in character or are outside of the scope of his own special technique.

—B. Gherardi, in O. and E. News.

FOREIGN POTENTIALS IN LONG LINE

A reader who has charge of the maintenance of a long line used for dispatching purposes by an oil and gas company, has a problem which he states in this way:

"We have a No. 10 copper circuit from S—— to L——, approximately 200 miles. This line crosses several rivers and any time the wire breaks and falls in the water, I get a 'foreign battery' reading on my voltmeter. It is only a slight reading, but enough to affect my measurements with a Galvanometer. What causes this?"

—J. O. W.

It is not an uncommon thing to find differences of potential between points on the earth's surface and the voltmeter reading is probably due to some of these conditions. This may be proved by establishing two ground connections of dissimilar metals, say copper and zinc, some distance apart and connecting a sensitive voltmeter between them. Another cause may be stray earth currents from traction or telegraph circuits. We are not quite sure how these potentials will affect galvanometer readings if the tester is using a Wheatstone bridge with the usual connection of the galvanometer across the arms and the battery to ground. Perhaps some of our friends who are doing their daily bit at the test boards of the long distance lines can give us some help.

TIME YOURSELF ON THIS ONE

We read this one in an exchange and we must admit we fumbled it, but we got it on the second bounce. You might try holding a watch on yourself to see how long it takes the point to make an impression:

Deskman to frameman: "Give me a short on ten par 2412 cable."

Frameman, holding the short on for a few minutes and not hearing from the deskman, called back, "How long do you want the short?"

NO OLD POLES FOR GUY STUBS

Some time ago, I delivered myself of some ideas on the use of a handaxe as a tool for line work. I am a little surprised that some hiker or grunt hasn't challenged me to mortal combat with handaxes as weapons, but since I came through safely, I am going to get another of my pet peeves off my chest. I have built a lot of line on jobs where we were furnished first class butt-treated poles, new cross arms and good hardware for the line, and then were expected to use almost any kind of an old second-hand pole for a guy stub. I have spent days with the gang on the same jobs with all of the blocks and falls that the company owned trying to get back into line corner poles that have gone over because any old guy stub rotted off at the ground.

This is the proposition that I can't see. When I build a corner, it is expected to stand up as long as the line and yet we will be expected to use a pole that can last only five or ten years for a guy stub.

If someone will explain the reason to me and make me see that it's a good one, I'll give him credit for brains that I never hope to possess.—Contributed by Bob Ewbank.

WHAT IS "TETRACHLORIDE"?

A Kansas subscriber sends us the following inquiry: "In your September issue of the Telephone Engineer, you state the word 'tetrachloride' which is used for cleaning points on telephone equipment. This is used in the paragraph on page thirty-four below figure six. I have tried to buy this tetrachloride, but no one seems to know what it is, therefore I would appreciate it if you will give me the information where I may purchase same."

The article had reference to the chemical compound "carbon tetrachloride." This compound is a commonly used and inexpensive cleaning fluid. Any first-class druggist should be able to supply it, although we must admit that we ourselves have found druggists who did not seem to know what it was.—Staff Contribution.

HAD TO DIG SECOND HOLE TO FILL UP THE FIRST ONE.

Some interesting experiences in digging holes in a desert country with an earth boring machine are told by W. L. Richardson in Long Lines:

"On the Dallas-El Paso line last summer this machine was used with good effect. In the flat desert country it was under a handicap, due to the fact that the wheels would sink down into the dry, loose sand. In mountains, however, where the surface was hard, it worked very well. This, notwithstanding the fact that the dobie and claeche earth was nearly as hard as rock. The natives said there had been no rain in that locality for about seven years and the soil bore out their statements.

"The earth taken from holes bored in this soil was as fine and light as powder. In open stretches, when the wind was blowing, this dust would vanish as soon as it was removed from the holes. When the poles were set, a second row of holes had to be dug to obtain sufficient material for the back fill."

THE PATH TO BIGGER PAY FOR PHONE MEN.

Practical telephone men are probably the most contented or the most dissatisfied by turn of any class of workmen on earth. They are usually content to go along with the class of work they are doing but are usually dissatisfied with the amount of compensation they receive. They seldom realize or will admit that they are receiving all they are worth, or that to receive an increase in salary they must make themselves more valuable to the concern by whom they are employed. Some will say that it is useless nowadays to study for a better job as everything is so specialized that "Once a lineman always a lineman." This may be true to a certain extent, but the condition has been brought about on account of the inability of most men to perform more than one class of work efficiently, or when working on one class of work being willing to prepare themselves for another.

If a man prepares himself for a better job, sometime the better position will be available for him. The best groundman in the gang is usually the first one selected to try out the climbers; the best lineman is selected for straw boss and then given a gang of his own; the best foreman in a district is the man selected for district construction superintendent and later higher positions. We frequently hear remarks that so and so is mighty lucky getting promoted to such a good position while someone else has worked so many years for the company and is still trouble shooter. It is usually a fact, when you get the inside story, that the man who was promoted spent some time each day in study, preparing himself for a higher position while the other didn't.

Few telephone men realize what one hour of study each day will accomplish in one year. I don't suppose that one practical telephone man in one thousand ever took a correspondence school course; this is proven by the fact that you never see a correspondence school advertisement in a telephone periodical but they are always numerous in fiction publications.

I do not wish to give the impression that the correspondence school is an ideal method of instruction for I do not consider them such. But the average practical telephone man who cannot spend the time or money to attend a recognized technical school will derive much benefit from a course in a reputable correspondence school. I do not mean a course in telephony necessarily but any good electrical course which can always be applied to our telephone work. I know a large percentage of the correspondence school courses started are never completed, and this is probably their greatest fault due to not being able to keep the student interested for the time required to complete all of the lessons. But show me a man that has completed one of these courses and I will wager that he will go far in the telephone game, for a man that has the stick-to-itiveness to work out the difficult problems without the aid of a personal instructor, will be able to work out practical problems by himself on the job.

It is also suprising how few telephone men outside of engineers subscribe to techincal publications and purchase technical books. I have invested a lot in books but have never bought a one that did not either save or make much more than the purchase price. Doctors, lawyers and other professional men would be lost without their reference library. I do not infer that the telephone man should maintain a library as large as the professional man but that at least a few good books should always be available for ready reference. Lack of knowledge often causes guessing which sometimes proves an expensive proposition.

If I owned a telephone exchange I would maintain a library of the best technical books and periodicals available and would insist that all men avail themselves of them at every opportunity and I believe it would prove a very good investment.

HE TOOK IT FOR GRANTED —AND DIED

There is nothing that depresses the minds of those interested in safety work more than a report that a fatal accident has occurred, and we immediately begin to wonder how, with all the precautionary measures we have taken, such an accident could have crept in, says E. C. Morgan, Maintenance Supervisor, The Western Union Telegraph Company, Atlanta, Ga., in the National Safety Council proceedings.

After detailed reports are reviewed we are sometimes struck with the simplicity of it all, and find it hard to realize how it could possibly get past us.

I sometimes think that if we were to purposely plan a fatal accident, our scheme would be so apparent that the victim would detect our purpose before the plan could be carried out.

Let me describe to you a fatal accident which snatched away the life of one of our men. Also let me explain to you how easily this accident might have been avoided.

For a number of years each lineman employed by the Western Union Telegraph Co. has been served with a written notice at the time of his employment, advising and warning him of the danger in climbing poles without first inspecting them to ascertain their condition. Each employee is instructed and warned not to climb a pole if there is any doubt about it being strong enough to support him safely and any strain which he may place upon it. When there is a doubt as to the condition or strength of a pole, he is instructed to take the necessary steps

to strengthen it before climbing. Poles are tested with a pike pole or rope, the tests are made by pushing or pulling the pole across the line, not with the strain in line with the wires.

Employees are warned not to untie the last wire on a defective pole until the pole is securely held by guys, braces or pike poles. It is often possible to lash an old pole to a new pole while the old pole is being dismantled.

These warnings, among others, are accepted by the linemen as part of their job, and they enter vitally into their every day work.

Picture, if you will, a small group of plant workmen carrying on under the direct supervision of a city foreman, in an average size town, where the telegraph company has, in addition to its main telegraph plant, circuits that are distributed over town in some sections on other companies poles, in order to reach patrons with their time, messenger and other classes of subsidiary service.

The city foreman knows his men and their capabilities, each of them is skilled in his work, accident prevention methods have been discussed and the safety first thought has been absorbed by the men who get out around town and work alone. Safety first has become a feature of their every-day work and when no accidents creep in to disturb the daily routine, the foreman is apt to forego repeating instructions on safe working practices to his men, and he takes it for granted they will realize where danger lurks and will take precautions to protect themselves.

In the course of a day's work, one of the linemen notices a pole of another company from which its wires have been removed, but upon which the telegraph company has two wires used as a clock circuit. The other company has rerouted its wires and it is apparent to the lineman that the pole is to be removed. It will be a simple matter to transfer the wires so that they will clear this pole and release it. On his return to headquarters he reports to the city foreman the necessity for the work. The foreman asks how much assistance he will require, and the lineman, believing the work can be easily accomplished, replies he can use one man, and without hesitation the city foreman assigns a man to assist with the work, instructing them to take whatever material and tools are necessary.

The first thing the next morning, the two men proceed to the scene—they will be designated as Mr. "A" and Mr. "B." No pike poles are taken and there is no evidence that the pole is tested. Mr. "A" puts on his climbing tools and climbs the pole. Mr. "B" remains on the ground. "A" reaches the crossarm, throws his leg over it, and unties the wires. "B," from his position on the ground, sees the pole start to fall, shouts a word of warning—too late, the pole catches in the limbs of the tree and its weight, with its human burden tears through and strikes the ground, with Mr. "A" underneath. The pole was rotted 21 inches below the ground line. Mr. "A" was killed.

How could this accident have been avoided?

(1st) Had warnings and definite instructions been followed by the men doing the work, no accident would have happened. When Mr. "A" stood on this scene the day before and planned in his mind the work necessary, he completely overlooked the hazard there might be in a pole to be abandoned.

(2nd) The city foreman to whom the necessity for the work was reported, also failed to picture in his mind a dangerous condition and when he told the linemen to take whatever material and tools were necessary, he was not definite enough and should have sensed a dangerous condition, even if his other work made it impossible for him to make a personal inspection.

(3rd) Both Mr. "A" and Mr. "B" failed to heed instructions and warnings that had been given them; they did not

Give yourself a Christmas present in cord economies

IN HIS constant battle to effect economies and improve the standard of service the telephone man finds the Runzel-Lenz Electric Mfg. Co. is a staunch and valuable ally.

For more than a quarter of a century our factory has specialized in cord making. Every day our experts are testing every bit of material that goes into the best cords it's possible to make. This concentration on just one product—cords—enables us to quickly seize every possible chance of improvement. That's why you are certain of Runzel-Lenz cords ever being superior in their life, their flexibility and strength.

Standardize on Runzel-Lenz cords as a New Year's resolution. You'll be able to give your company a Christmas present next year with the savings you have made in cord tests.

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Specialists in Cord Manufacture for the Telephone Industry

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take the necessary tools and material to do the job safely; they should have taken along pike poles and ropes so that the pole might have been tested, and even if a pike pole test failed to show the defect, as a precaution, the pole could easily have been lashed to a nearby stub.

Mr. "A's" position on the pole was wrong, there was no necessity for going above the crossarms, his proper place on the pole was under the crossarm on the side of the pole, away from which wires were pulling, in a position where he could hook his leg around the pole and reach up, untying the wires. In this position he would have had a much better chance when the pole started to fall.

To prevent an accident of this character, nothing must be taken for granted, instructions must be followed, warnings must be heeded by the men actually doing the work.

Foremen and others who direct work must never let a chance go by to repeat a warning and stress the necessity for precaution. The city foreman in this case should have said, "Don't climb that pole until you have tested it with pike poles; then guy it or lash it to an adjacent pole before you climb it."

We see from this accident that despite warnings, despite instructions, despite direct supervision, accidents can creep in, and only by anticipating such an accident and taking proper steps to see that instructions and warnings are followed, can they be avoided.

POWER MACHINERY HASN'T REACHED PHILIPPINES

Ray Blain, who has contributed a number of interesting pictures of telephone conditions in the Philippine Islands, sends a series of four pictures that indicate that power driven machinery for telephone construction work has not yet taken the place of man power in the

Fig. 1

islands. In Fig. 1, the pick and shovel still holds its place in spite of development of trench digging machines.

Not one but several "concrete mixers" are shown in Fig. 2 where the shovel and mortar board serve in place of the more familiar gas-engine driven "mixer" used in the States.

Henry Ford's dump-body equipped

Fig. 2

truck apparently has not yet reached the islands to combat the supremacy of the "Irish Gondola" used for transporting concrete as shown in Fig. 3.

Fig. 3

Even cable can be pulled-in by hand if man power enough is available. Personally we would prefer to use a winch equipped truck instead of the method shown in Fig. 4.

Fig. 4

AUTO HEADLIGHT ADJUSTMENT

During the winter months telephone company automobiles frequently are on the road after dark and the condition of the lighting equipment, often neglected during the summer months, should be given attention. In a recent paper by J. W. Bray of the Westinghouse Lamp Co., published in The Travelers Standard, are given suggestions regarding the adjustment and care of the lighting equipment. Mr. Bray gives the following chart and directions for headlight adjustment:

Equipment

1. A chart, or a wall upon which a chart can be painted.

CHART FOR USE IN ADJUSTING AUTOMOBILE HEADLIGHTS

(The positions of the light horizontal and vertical lines will vary with different cars—they indicate, respectively, the height of the center of the headlights above the ground, and the distance from the center of the car to the center of the headlights. The chart here shown would be suitable for use only in connection with cars having headlights 30 inches from center to center in a horizontal direction, and with the centers of the lamps either 30 inches or 42 inches above the ground. The testing of the headlights on several cars of different kinds would be facilitated by drawing additional vertical and horizontal lines about two inches apart.—Editor.)

2. A dark room or inclosure, long enough to include a car and to allow an additional distance of 25 feet from the headlights to the chart or wall. The floor must be level and be at a right angle with the chart or wall.

3. A screw-driver, a wrench, and a yard-stick or tape.

Condition of Equipment

Under the subject of headlight adjustment, should be included not only the focusing of lamps and the aiming of beams, but also the condition of reflectors, sockets, lenses, wiring and battery, all of which directly concern the operation of the lamps.

The reflectors and lenses should be clean.

The sockets should not wabble, because this decidedly affects the focusing and the permanence of the lamp adjustment. The sockets should move freely in the guides, however.

All wire-connections should be clean, and be fastened tightly. A poor connection greatly reduces the voltage, which in turn lowers the candle-power. The battery condition also affects the candle-power, and to get the best results it is desirable to realize 6.5 volts at the lamp socket, with the engine running.

Procedure of Headlight Adjustment

Place the car in the darkened space so that the headlight lenses are 25 feet from the chart, and so that the center line, from the back of the car over the radiator cap, is exactly in line with the center of the chart. Cover one headlamp with a blanket or cloth, and on the other lamp turn the little adjustment screw with a screw-driver to the left or right until the pattern of light on the chart is the smallest in the up-and-down direction and cut off sharply along the upper edge.

Loosen the nut which holds the headlamp from turning, and point the center of the beam directly ahead. The distance

from center-to-center of the headlamps should be the same as the distance from center-to-center of the beams on the chart.

The height of the beam must now be considered. Measure the height of the headlamp centers from the floor, and if the car is empty while you are making this adjustment, subtract the loading allowance figure to obtain the correct height of the beam on the chart.

Loading Allowance for 25 Feet Ahead

Trucks

Light delivery trucks	8″
1 to 3 ton trucks	5″
Over 3 ton trucks	4″

Passenger Cars

Wheel-base.	Touring.	Sedan.	Coupe.	Roadster.
100-110...	8″	7″	6″	5″
110-120...	7″	6″	5″	4″
120-130...	6″	5″	4″	4″
130-140...	5″	4″	3″	3″

For instance, if the center of the headlamps on a 100-inch wheel-base touring car were 40 inches from the floor, by subtracting 8 inches we obtain a figure of 32 inches as the correct height of the pattern on the chart.

A universal joint or a slot under one of the bolts fastening the headlamp to the fender or frame is usually provided to facilitate aiming. On some cars (the Ford for example) the headlamp bracket must be bent by using a long wrench for a lever. The upper edge of the pattern on the chart must not go above the correct height of the beam when the car is not loaded.

Now, cover this headlamp and uncover the other one, and follow the same procedure with it. When finished, the pattern of both headlamps on the chart should be narrow in the up-and-down direction, very brilliant at the central part, and fading away in brightness toward either side.

Relay Axle Drive and Service Motor Trucks United

E. W. Bassick and W. R. Bassick, formerly president and vice president of the Bassick Manufacturing Co. (manufacturers of Alemiate Lubricating System), E. S. Evans, well known manufacturer of automobile loading devices, and M. H. Furlaud, banker of New York and Paris, in order to care for expanding business and to further carry on the development of their Relay Axle equipped truck, have acquired the capital stock of Service Motors, Inc., Wabash, Ind. The Service plant is one of the finest truck plants in the country with a floor space of approximately 250,000 sq. ft., giving a capacity of 10,000 to 12,000 trucks per year. G. L. Gillam, president of Service Motors, Inc., will be an officer of the new corporation, in active charge of operations. M. A. Holmes, for years sales manager of the Republic Truck Co., now sales manager of the Commerce Truck Co., will be in charge of sales for the new corporation.

Laud McLean's Re-Election at Hillsboro (Ill.)

Hillsboro, Ill.—Re-election of Walter McLean as secretary and general manager of the People's Mutual Telephone Co. here has elicited considerable favorable comment in the columns of newspapers in Hillsboro and surrounding territory. McLean is credited with being the leading figure in giving residents of the Hillsboro territory splendid telephone service during the 14 years of his management of the company.

Blake Staples Have Satisfied for 26 Years

For twenty-six years Blake Insulated Staples have been giving effective service on interior telephone wiring and other such low voltage circuits. Properly proportioned, properly designed and properly made of the best of material they have stood the test of the most exacting service such as telephone, burglar alarm and time clock, not to mention automobile, radio, motor boat, and all kinds of annunciator and low voltage circuits. The broad double thickness of the best, hard-finished, rag-fibre insulation is provided to give perfect mechanical and electrical protection and insure against short circuits and grounds on wiring in the most trying circumstances of damp, foggy seashore climate and the dampest cellar condition of the dampest dog day weather.

Telephone Business Growing at Rate of Over 13%

Washington, D. C.—Seventy-one large telephone companies had an aggregate operating income of $154,084,615 in the nine months ended with September, an increase of 13.4 per cent over the income for the corresponding period of 1925, according to the Interstate Commerce Commission.

For September the operating income was $18,152,978, an increase of 12.8 per cent over September, 1925. At the end of September the number of stations these 71 companies had in service was 13,611,229, an increase of 823,322 in one year.

We'll Soon Telephone Foreign Lands; Already Sending Pictures

Washington, D. C.—D. B. Carson, United States commissioner of navigation, predicts that radiotelephone service between the United States and Great Britain is not far in the future.

Commercial pictoradiogram services now operate between New York and London and San Francisco and Hawaii. By this means photographs, pictures, advertisements, bank checks and even finger prints are quickly transmitted and reproduced.

Telephones Are Cheap Compared to Our Non-Essentials

Washington, D. C.—The average American spends less than half as much for his telephone service as he (or she) spends on candy and soft drinks or on cigars and cigarettes. Even the radio and music in general take more out of the public pocket than does the telephone. Cosmetics and perfumes draw more dollars than the annual telephone bill, while the movies and the theater also top the telephone when it comes to getting the American cash.

Ohio Bell Authorizes $20,000,000 Expenditures in One Year

Cleveland, O.—The Ohio Bell Telephone Co. has authorized further expenditures of about $3,000,000 for additions and improvements to Ohio properties, bringing the appropriations for these purposes since the beginning of 1926 to more than $22,000,000.

The Michigan Home Telephone Co. has taken over the properties of the United Home Telephone Co. of Muskegon, and the Grand Ledge Telephone Co., of Grand Ledge, which were purchased recently by True, Webber and Company, investment brokers of Chicago. The company will be incorporated with a capital of $2,000,000.

The "Supreme Authority"

WEBSTER'S NEW INTERNATIONAL DICTIONARY

—THE MERRIAM-WEBSTER

Because

Hundreds of Supreme Court Judges concur in highest praise of the work as their *Authority*.

The Presidents of all leading Universities, Colleges, and Normal Schools give their hearty *Indorsement*.

All States that have adopted a large dictionary as *standard* have selected Webster's New International.

The Schoolbooks of the Country *adhere* to the Merriam-Webster system of diacritical marks.

The Government Printing Office at Washington uses it as *authority*.

G. & C. Merriam Company
Springfield, Mass.

Get The Best!

45E

Wind Should Insures Efficient Operation in all Kinds of Weather.
Patented Large Non-Heating Valve Wheel
Removable Burner Block, Orifice cannot be enlarged
Patented Furnace Type Burner. Greater Heat and Continuous Operation
Easily Removable Needle Cleans Burner Orifice Every Time Valve is Opened or Closed
Large Pressed Steel Drip Cup Brazed to Supply Pipe
Clevis
Angle Handle Restful and Easy to Hold
Filler Plug on Top Easily Filled. No Chance for Dirt to Enter
Handle Support Does Not Extend Through Tank
Pump Has Double Check Valve. Second Held in Place by Clevis
Flared Base for Greater Stability
Steel Tank with Bottom and Three Connections Only Brazed. Every Tank Tested to 100 lbs. Pressure
Three Thicknesses of Steel Where Greatest Wear Takes Place

Look into this new WALL

"Service with Safety"

DREADNAUGHT

This new steel torch combines all the advantages of the time-tried older Dreadnaughts with a number of improvements. Built for heavier work, to give a bigger, hotter flame. New burner cleans itself automatically. All joints brazed with hard brass spelter solder; every torch tested. Can be used in all kinds of weather. A better "service with safety" torch that has been adopted by many of the largest public utility companies. Let us tell you more about the new Dreadnaught No. 41.

P. WALL MFG. SUPPLY CO.

3126-66 Preble Ave., N. S. PITTSBURGH, PA., U. S. A.

Since 1864

"The Smile with the Voice" Invites Them

HELLO! IS THIS
THIS IS MISS GRIGGERS
OF THE TELEPHONE COMPANY SPEAKING.
MR. MASON HAS ASKED ME
TO INVITE YOU TO ATTEND
THE OPENING OF OUR NEW BUILDING
AT 155 MARINE ST., OCEAN PARK
MONDAY EVENING, NOVEMBER 22, 1926
FROM 7 o'CLOCK TO MIDNIGHT.

When the Santa Monica Bay Telephone Company planned the opening of its new building, it sent out the above invitation. Now who'll have the heart to condemn Miss Griggers if they get a wrong number? This is one of the many opportunities seized by the enterprising California company to give a bright personal touch to its advertising.

One of Every 280 Persons in U. S. Are "Our Folks"

More than 400,000 persons, or one out of every 280 of the entire population of the U. S. are engaged in telephone work, either in the operating or manufacturing branch of the industry.

Set World Record With New Cable Splicing Machine

South Gate, Cal.—An ingenious cable splicing machine invented by J. W. Channell, a local telephone man, recently set a world's record in splicing a 1212 pair cable. The Channel machine has been demonstrated before several of the larger telephone companies, and has received a highly favorable reception with prospects of early adoption in a number of cases.

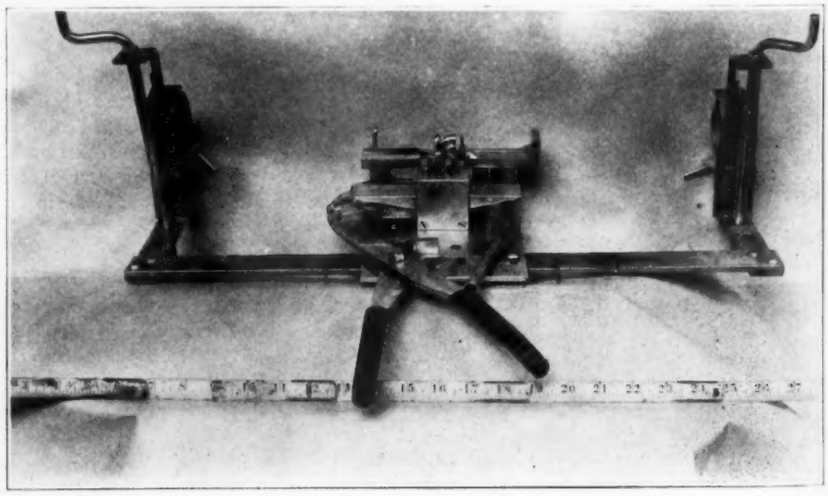
The record as established on the 1212 pair cable:

Bunch No. Colors.	No. Pairs.	Start.	Finish.	Splicing Time.	Change Machine.	Total Time.
1 ... R.–G.	51	8:05 A.M.	8:14 A.M.	9 min.	.....	9 min.
2 ... R.–B.	51	8:14½ A.M.	8:23 A.M.	8½ min.	½ min.	9 min.
3 ... G.–W.	51	8:25 A.M.	8:35 A.M.	10 min.	2 min.	12 min.
4 ... O.–W.	51	8:36 A.M.	8:45 A.M.	9 min.	1 min.	10 min.
5 ... B.–W.	51	8:46½ A.M.	8:57 A.M.	10½ min.	1½ min.	12 min.
6 ... R.–W.	51	8:58 A.M.	9:07 A.M.	9 min.	1 min.	10 min.
7 ... R.–G.	51	9:09 A.M.	9:19½ A.M.	10½ min.	2 min.	12½ min.
8 ... R.–B.	51	9:20 A.M.	9:30 A.M.	10 min.	½ min.	10½ min.
9 ... G.–W.	51	9:31½ A.M.	9:41½ A.M.	10 min.	1½ min.	11½ min.
10 ... O.–W.	51	9:42 A.M.	9:53 A.M.	11 min.	½ min.	11½ min.
11 ... B.–W.	51	9:54½ A.M.	10:04½ A.M.	10 min.	1½ min.	11½ min.
12 ... R.–W.	51	10:05 A.M.	10:14½ A.M.	9½ min.	½ min.	10 min.
12 ... R –W.	50	10:16 A.M.	10:26½ A.M.	10½ min.	1½ min.	12 min.
11 ... B.–W.	50	10:27 A.M.	10:38 A.M.	11 min.	½ min.	11½ min.
10 ... O.–W.	50	10:38½ A.M.	10:49 A.M.	10½ min.	½ min.	11 min.
9 ... G.–W.	50	10:50 A.M.	11:03 A.M.	13 min.	1 min.	14 min.
8 ... R.–B.	50	11:04½ A.M.	11:15½ A.M.	11 min.	1½ min.	12½ min.
7 ... R.–G.	50	11:16 A.M.	11:26½ A.M.	10½ min.	½ min.	11 min.
6 ... R.–W.	50	11:27½ A.M.	11:37 A.M.	9½ min.	1 min.	10½ min.
5 ... B.–W.	50	11:37½ A.M.	11:47 A.M.	9½ min.	½ min.	10 min.
4 ... O.–W.	50	11:48 A.M.	11:59 A.M.	11 min.	1 min.	12 min.
3 ... G.–W.	50	12:00 M.	12:12 P.M.	12 min.	1 min.	13 min.
2 ... R.–B.	50	12:12½ P.M.	12:24 P.M.	11½ min.	½ min.	12 min.
1 ... R.–G.	50	12:25 P.M.	12:36½ P.M.	11½ min.	1 min.	12½ min.
Total ...1,212		8:05 A.M.	12:36½ P.M.	4hrs.8½m.	23 min.	4hrs.31½m.

There was no failure of the machine during the test.

The machine was operated by Mr. J. W. Channell, with Mr. C. M. Rutherford as helper; Mr. J. A. Jordan, timekeeper.

The best time made previous to this test was 5 hrs. 45 min. total time.



This Is the Channell Cable Splicer That Set World Record

Here is the Place
for your next convention

CAN'T you just picture the wonderful time you would have at world famous French Lick Springs Hotel? Beautifully located in the semi-southern Cumberland foothills of Indiana, French Lick Springs knows no real severity of temperature. The two fine 18-hole golf courses can be played when weather interferes with play elsewhere.

Only 40 miles from the center of population of the United States. The recently completed new wing of the fire-proof, modern French Lick Springs Hotel building includes a well-ventilated ground floor, daylight convention auditorium of 1500 seating capacity, giving this hotel first place among America's convention sites. And, for those who wish, the health-giving waters of the Pluto, Bowles and Proserpine Springs.

Today, get full particulars. Write for illustrated booklet with detailed convention information. Address Convention Secretary, French Lick Springs Hotel Company, French Lick, Indiana.

FRENCH LICK SPRINGS HOTEL

"Home of Pluto Water"

Telephone Company Financing

THE Continental Telephone Company is an organization composed of men who have been prominent in the Independent field for many years, and are now operating successful properties. Headquarters for the Company are at St. Paul, Minnesota, and Lincoln, Nebraska.

The Continental Telephone Company invites correspondence from telephone companies anywhere in the United States, whether they are seeking funds for expansion or desiring to market their property.

When writing give number of stations, annual revenue, type of equipment and population served.

Continental Telephone Co.

Tri-State Telephone Building
St. Paul, Minnesota

Lincoln Telephone & Telegraph Bldg.,
Lincoln, Nebraska

American Steel & Wire Strengthens Birmingham Service

Birmingham, Ala. — The American Steel & Wire Co.'s Birmingham (Ala.) office has been greatly enlarged for serving the trade in the most prompt and efficient manner. J. J. Gilmore, heretofore in charge, has been promoted to be Manager of Sales, with a competent force to assist him and sufficient traveling representatives to keep in close communication with the trade throughout the Birmingham district. In all sections of the country a healthy expansion is going on and in no section is it more noticeable than in the South. This reflects the general optimism under present wholesome and substantial business conditions.

Abbott, Illinois Bell, Sees Cross-Seas Service Soon

Chicago, Ill.—W. R. Abbott, president of the Illinois Bell Telephone Co., speaking before the Chicago Association of Commerce, Nov. 3, said, "it is expected that commercial telephone service between the United States and England will be established in a few months, and it is the hope of our engineers that, within a measurable time it will be possible for a telephone user anywhere in this country to talk with a telephone user anywhere in Europe."

Tom Clark Gets Big Job with Matthews Corp.

St. Louis, Mo.—The W. N. Matthews Corporation has appointed Thomas C. Clark to the territory formerly covered

by W. M. Watters. Mr. Clark is an electrical engineer and received his education at the Missourn State and Washington universities. In 1910 he entered the employ of the Union Electric Light and Power Co., St. Louis, as an apprentice lineman. Early in 1911 he was transferred to the Estimating and Field Layout Division of the Distribution Department. In 1916 he headed this branch of the service. In 1923 he was made Superintendent of Construction for the Central Overhead Division, which position he held up to November 11, 1926.

The territory which Mr. Clark will cover includes all of the states of Iowa, Nebraska, Kansas, Missouri, Oklahoma, Arkansas, Kentucky and Tennessee west of the Tennessee River and the Southwestern part of Illinois. It is believed that his engineering and construction experience will be of considerable value to the many customers of the Matthews Corporation in his territory. His headquarters will be in St. Louis.

Fairmount, Neb.—Lincoln T. and T. Co. is reported as planning construction of a $12,000 exchange building here.

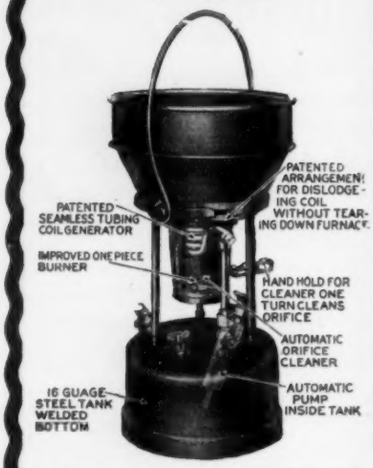
Huntsville, Mo.—J. O. Kent, Memphis, Mo., has bought the local telephone exchange.

Mountain View, Ark.—J. E. Gardner of Calico Rock has bought the local telephone exchange from L. P. Downey.

Easy to See Why the

UNIQUE FURNACE

is preferred


PATENTED SEAMLESS TUBING COIL GENERATOR
IMPROVED ONE PIECE BURNER
16 GUAGE STEEL TANK WELDED BOTTOM
PATENTED ARRANGEMENT FOR DISLODGING COIL WITHOUT TEARING DOWN FURNACE
HAND HOLD FOR CLEANER ONE TURN CLEANS ORIFICE
AUTOMATIC ORIFICE CLEANER
AUTOMATIC PUMP INSIDE TANK

Many of the foremost Bell and Independent companies have standardized the Unique Furnace. It melts 50 lbs. of lead in 10 minutes. An automatic orifice cleaner assures continuously efficient operation. It's sturdy and simple.

"UNINTERRUPTED SERVICE"—the result of a "UNIQUE DESIGN and BETTER CONSTRUCTION."

Literature ready—BLOW TORCH and Furnace.

UNIQUE MFG. CO.

113 N. Des Plaines St. Chicago

CHOICE OF THE LEADERS

Everstick

Approved by Large Operating Companies For the Following Strains

6" 2-way	2,200 lbs.
6" 4-way	6,000 lbs.
8" 2-way	6,000 lbs.
8" 4-way	10,000 lbs.
10" 4-way	16,000 lbs.

Write for Details

Everstick Anchor Co.

ST. LOUIS, MO.

Arthur W. Page, Publisher, Goes with Bell Organization

New York City—Arthur W. Page has resigned as vice president of the publishing firm of Doubleday Page and Co., and the editorship of the World's Work to become a vice president of the A. T and T. Co.

Turlock, Cal.—J. L. Randolph, owner of the Turlock Home T. and T. Co., is selling his property to the Pacific T. and T. Co.

South Dakota Promises Big Meeting, Jan. 11-13

Aberdeen, S. D.—The South Dakota Telephone Association's next annual convention will be held at the Cataract Hotel, Sioux Falls, January 11, 12 and 13, 1927.

Arrangements have been made with the hotel management to reserve rooms for exhibitors, located on the same floor as the convention hall. The officers of the association and the committee in charge of the convention program and arrangements are anxious to have as many of the manufacturers and jobbers exhibit at this convention as is possible.

From indications the association predicts a very large attendance and it will be appreciated if sales representatives will make it a point to mention our convention dates as they call on the South Dakota trade, also those independent telephone companies tributary to Sioux Falls but located in Iowa and Minnesota.

The committee has arranged the program in such a way as to give those who attend the convention ample time to visit the exhibits and to meet sales representatives.

"Kid" Interference in Company Skit

Dallas, Tex.—A comedy skit presented by operators of the Southwestern Bell Telephone Co. at a recent meeting of the Dallas Electric Club, picked Beeman Fisher, publicity director of the Texas Power and Light Co. as the down-trodden hero of a tabloid drama in which power wires and the telephone lines became tangled.

Russia Reports 533 Exchanges in Soviet Figures

Leningrad, Russia—The Soviet Government lately issued a report on the position of the telephone system of Russia at the end of October, 1924. It shows that at that date there were 533 telephone exchanges in the country, with a total of 121,275 subscribers, the length of the telephone cables in use being 693,750 miles, and the wires lines 157,100 miles.

Northwestern Bell Magazine Given Highest Award

Detroit, Mich.—The Northwestern Bell, the employees' magazine of the Northwestern Bell Telephone Co., was declared the best all around employees' magazine in the United States by a committee acting at the National Safety Congress session.

Paris, Ill.—C. M. Bowling, for several years representative for the Kellogg Switchboard and Supply Co., has been appointed commercial manager of the Wabash Valley Telephone Co. here.

New Cook Terminals

26 pair S-18-D terminals	$10.00
51 pair S-M-1 terminals	22.50
102 pair T-5 terminals	25.00
16 pair T-29-D terminals	3.50
10 pair, 16 pair, 26 pair M-8 terminals $2.25, $3.00 and	4.00
16 pair, 26 pair, M-10-1 terminals $7.00 and	10.00
26 pair, M-10-1 terminals with 6 ft. stub	12.00
11-16-26-51 pair, M13 terminals $3.00, $3.50, $5.00 and	6.50
No. 1 lightning arresters	1.00
No. 3 lightning arresters	.40
No. 7 lightning arresters	1.10
No. 11 lightning arresters	1.50
No. 22 lightning arresters	1.40
B-10 sub-station protectors	.10
B-15 sub-station protectors	.50
Large splicing clamps	1.00
Small splicing clamps	.75

All equipment new and in original packages.

BUCKEYE TELEPHONE AND SUPPLY CO.

COLUMBUS, OHIO

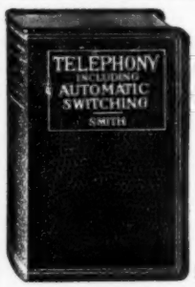
Only $39.00

For This Highest Grade Auto Trailer

½ Ton Capacity.

Three styles of body to choose from. Can furnish extension tongue for hauling poles, solid rubber tires. Light weight, easy-running. Write for catalogue.

Bower Mfg. Co., 15 Ade St., Fowler, Ind.



A Great Practical Book *for the* Practical Telephone Man

TELEPHONY

including

AUTOMATIC SWITCHING

By Arthur Bessey Smith

The following brief outline shows the scope of this work: The magneto receiver, local and common batteries, instruments, private lines and exchange, multiple and "feature" switchboards, automatic switching and telephone instruments, 100, 1000 and 10,000 line exchange, party lines, multi-office exchange, large city systems, private automatic exchange, power plants, testing and adjusting, toll, phantom circuit, loading of lines, measured service, index.

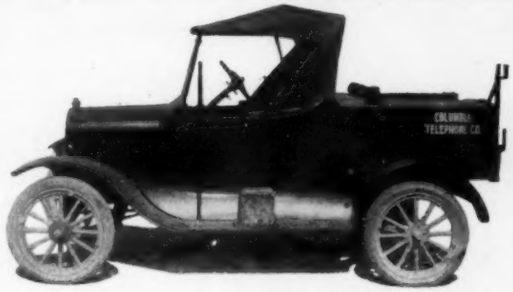
The price of TELEPHONY, including AUTOMATIC SWITCHING, is $2.50

TELEPHONE ENGINEER

225 N. Michigan Ave. Chicago, Illinois

Minneapolis, Minn.—Charles A. Kellogg, chief clerk in the office of R. F. Wilder, general commercial manager of the Tri-State, and a veteran telephone man, died here following a prolonged illness.

Cokato, Minn.—Cokato Telephone Co. is erecting a plant here.



Type SC-172

Cabinet Body for Ford Roadster

A STRONG, light-weight, convenient cabinet body used in connection with the standard Ford roadster. Soon repays its first cost. Standard equipment with some of the largest telephone and power companies. Equipment includes ladder irons and rear fenders.

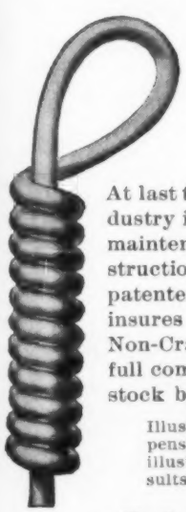
Write for Bulletin No. 214 giving prices and full information

HOOVER BODY CO.

YORK, PENNSYLVANIA

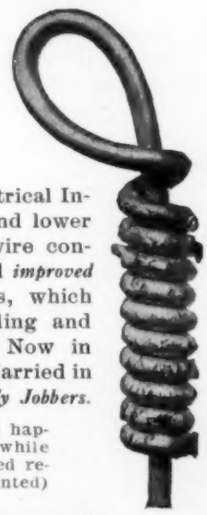
"INDIANA"

Double Galvanized Telephone and Telegraph Wire



Crapo Patents

Non-Peeling
Non-Cracking



At last the Telephone and Electrical Industry is assured longer life and lower maintenance on galvanized wire construction through our *new* and *improved* patented Galvanizing Process, which insures a wire with Non-Peeling and Non-Cracking Zinc Coating. Now in full commercial production. Carried in stock by Representative *Supply Jobbers*.

Illustration at right shows what happens to old process galvanizing, while illustration at left shows assured results of Crapo process—(patented)

Galvanized Steel Strand

Standard or Commercial, Siemens-Martin, High Strength and Extra High Strength Grades

Indiana Steel & Wire Co., Muncie, Ind.

The Standard for Telephone Work

KESTER SOLDER

Rosin-Core

In the telephone field Kester Solder is the standard for both maintenance and production work. The comprehensive line of Kester Solder embraces a range of sizes from approximately 1/4″ to 1/16″ in diameter. Standard Acid Core diameter, being 1/8″ and Standard Rosin Core diameter 3/32″. Packed on one, five, ten and twenty pound spools, there is a range of size and style of package suitable for every practical purpose.

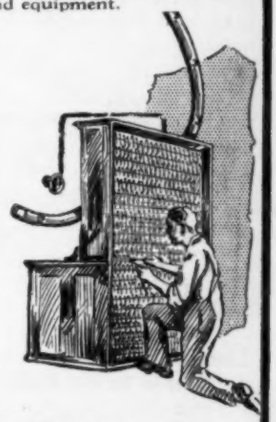
For heavier electrical work Kester Acid Core Solder can be used with considerable saving in time, labor and material.

For the more delicate electrical work on switchboards, etc., only Kester Rosin Core Solder should be used. Its pure rosin flux eliminates every danger of corroded work.

Most telephone companies specify Kester Rosin Core Solder No. 2, 50 core for cable line splicing as it not only conforms with the standard specifications, but also speeds up this class of work.

Kester Solder either rosin or acid core is handled practically everywhere by jobbers of telephone supplies and equipment.

We maintain a completely equipped research laboratory where we have solved soldering problems for many manufacturers. While our standard line of Kester Solder is adequate for practically every soldering job there are occasions where a specially developed solder and flux are required.



Consult our Research Engineer on your soldering problems

"Requires Only Heat"

CHICAGO SOLDER COMPANY

4218 Wrightwood Avenue Chicago, U. S. A.

Originators and world's largest manufacturers of Self Fluxing Solder

Movie Influence Shown in Monarch Phone Demand

Chicago, Ill.—Two of the Monarch line of telephones that are getting plenty of space in the order books these days are the Como-Fone and the Magno-Fone, which are the common-battery and magneto telephones of the type which combines the transmitter and receiver in a single unit, supported, when out of use on a cradle unit which operates the switch.

The Monarch people credit the great popularity of this type of instrument to the movie influence for the type is one frequently shown in the films where the big-business or high-life atmosphere is marked. This gratuitous advertising has reached into the small towns with the same force as it reaches the metropolitan communities. Monarch representatives report that telephone companies are having no trouble in getting at least 25c a month more from subscribers who have this type of instrument installed.

Telephoto Service Extends—Cleveland Added

Cleveland, O.—Commercial telephoto service has been opened officially between Chicago and Cleveland by the American Telephone and Telegraph Co. New York, Boston and San Francisco already were on the Chicago circuit and Atlanta, St. Louis and Los Angeles soon are to be added.

It is significant that Cleveland, now the fifth largest city in the United States, had the honor of sending the first telephoto news picture. Back in 1924, when it was in the experimental stage, the first telephoto was transmitted from the Republican National Convention to New York City newspapers.

Kearney Corp. Announces Appointments

St. Louis, Mo.—The James R. Kearney Corp., manufacturers of overhead and underground utility equipment, announces that the following have recently joined the sales organization: Herb. Keller and Arthur Miller, of Power Machinery Co., Kansas City, as special representatives in the Kansas City territory; W. M. Watters, as special representative in the St. Louis territory, and J. J. Costello as representative in the New England States territory with headquarters in Boston.

Long Distance Underground Cable to Be Built in Italy

Rome, Italy—Government has approved the plan for connecting Naples with Rome and Milan by an underground interprovincial cable. Cost is estimated at 500 million lire, and the scheme will take five years to complete.

Cartoon Praises Mason at Santa Monica (Cal.)

Santa Monica, Cal.—A lively realization of what's news in a telephone company's operations has done its bit in making the Santa Monica Bay Telephone Co. stand in the good graces of the city's residents. One of the policies of Charles

Spy Glass
COPYRIGHT - 1926 - G.M. OUTLOOK
By WIN SMITH
CHARLES F. MASON - BEFORE CHARLIE BECAME MANAGER OF THE BAY TELEPHONE CO., WE COULDN'T EVEN GET CENTRAL — TODAY EVERYBODY ON THE BEACH HAS EVERYBODY ELSE'S NUMBER!!!

E. Mason, manager of the company, is to always tip local reporters off to what's going on in the company's work, and to promptly and completely tell them the company's side of any affair that involves this utility.

There is a lot of personal interest to this publicity as the reporters frequently dig up some material with an active human "slant" to it. One of the recent features of an enterprising Santa Monica newspaper was the Mason cartoon reproduced on this page.

Fulton, Ill.—Extensive improvements are being made to the outside plant of the Tri-City Telephone Co. here.

Belgium Plans Change in Wire Organization

Antwerp, Belgium.—The Belgian Government is engaged in the preparation of a Bill for presentation to Parliament in October, providing for the transference of the State telephone and telegraph system to a company in a manner similar to the so-called "industrialization" of the State railways. The capital of the company is to be 1,800,000,000 fr., of which 1,500 millions would be in the form of preference shares and be offered to the public, while the balance of 300 millions would be ordinary shares with multiple voting rights and be held by the State. It is stated that the scheme is proposed in connection with the stabilization of the Belgian currency, and that it is intended to provide further funds for the Treasury or the sinking fund.

Graybar Building a City in Itself

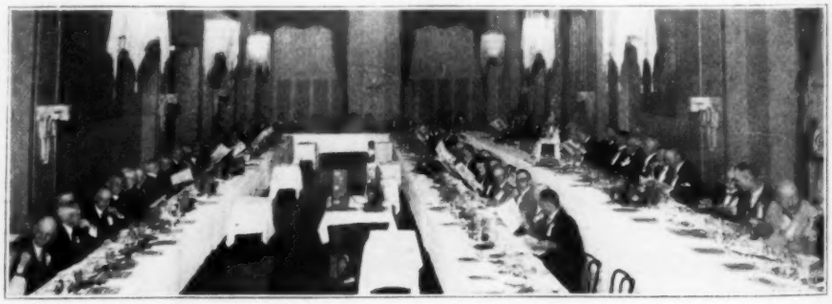
New York City—There are only 42 cities in New York State with a greater population than that which the world's largest office building—the Graybar building, taking its name from the Graybar Electric Co., will house when completed. This building, being erected between Lexington Ave. and the Grand Central Station, will have 1,350,000 sq. ft. of floor space and a population of 13,500.

French Deny Prospect of Sale to Foreign Interests

Paris, France—Ministry of Posts and Telegraphs has denied that there is foundation for the current rumor that the French telephone system is to be acquired by foreign capital. Study of foreign automatic systems by the French authorities is said to have been misinterpreted as the preliminary action of a sale by the government.

Miles City, Mont.—Following sale and reorganization of the local telephone company arrangements are being made to extend the lines to Broadus.

HOW CHATTANOOGA OBSERVED SEMI-CENTENNIAL



Southern Bell Telephone Company was host at a birthday party to a throng of Chattanooga's pioneers and foremost business men. The occasion was the celebration of the fiftieth anniversary of the telephone and the forty-sixth birthday of the Chattanooga telephone system.

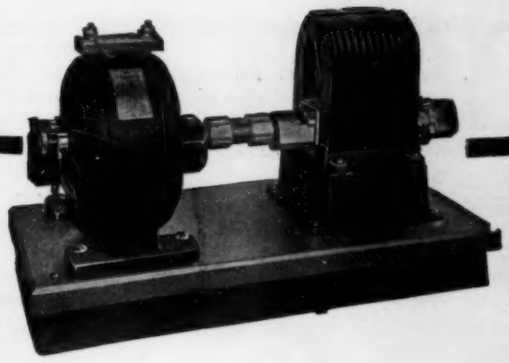
BRACH VACUUM ARRESTERS

at prices within your reach

When the best protection costs no more, why not have it? BRACH arresters insure; non-grounding of lines, cables, clear transmission, balance of potential between pairs, and full protection against power crosses or lightning. There are no carbons to clean and no maintenance bills.

You can readily afford BRACH Vacuum Arresters at our present low prices. Type 440, showr above, is furnished with porcelain base, fuses and mountings.

L. S. BRACH MFG. CO.
NEWARK, N. J.



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Do Away with Batteries

Wipe out the constant attention and replacement costs required to render ring service.

Install a **Holtzer-Cabot** Magneto-Ringing Motor Generator which does its work under all conditions without variation.

It never fails—gives constant service at a lower cost than any other ringing method.

The Holtzer-Cabot Electric Co.

125 Amory St., Boston, Mass. **6161 So. State St., Chicago, Ill.**

For Maximum Service—Baker Contact Points

DEPENDABILITY and long life are the two essentials in a contact point. This "heart of the machine" should function evenly and steadily over long periods of time—it should not need replacement at frequent intervals.

Baker Contact Points are made with this principle always in mind and the name "Baker" assures that perfect performance, without constant renewal, which is the outstanding characteristic of a *good* contact point. Our contacts are made of Platinum, Iridio-Platinum, Silver and Special Alloys. There are sizes and types for all purposes.

BAKER & CO., INC.
54 Austin St., Newark, N. J.
NEW YORK **CHICAGO**

Two In One

The Anderson Trouble Finder is a combined testing instrument and a portable telephone —all in one.

Equip your trouble men with this rugged device and they will be able to quickly detect all forms of line trouble, thus reducing circuit time loss to a minimum. The speed and the results obtained with the Anderson Trouble Finder will please you.

The fact that the Anderson Trouble Finder has been approved by engineers of many leading telephone and railroad corporations is evidence of its practicability and economical value. These same companies are ordering and re-ordering Anderson Trouble Finders continually.

Write for further information

The West Manufacturing Co.
447 Monadnock Block **Chicago, U. S. A.**

Texas Draws Hundred to District Meeting

Dallas, Tex.—What was pronounced the most helpful district meeting of the Texas schedule was held here the middle of November. Approximately 100 Texans attended the conclave.

George McQuaid, director of the Texas Public Service Information Bureau, spoke on "Getting Along With the Public."

T. N. Wathen of the Southwestern Bell Telephone Co. made an illuminating talk on "New Toll Rates." "Toll Circuits—Using Them to the Best Advantage" was the subject assigned to R. E. Glaze, district traffic chief of the Southwestern Bell Telephone Co. at Corsicana, and he went into the subject thoroughly.

H. B. Whatley of the Southwestern Bell Telephone Co., Dallas, summed up the talks of the day.

Sam H. Shutt, general superintendent of the Texas Long-Distance Telephone Company, Waco, suggested a few questions, but got rid of the question box in short order. Most questions, as it happened, had been answered by either Mr. Glaze or Mr. Whatley. Earl Evans of Waco presided at the afternoon session.

Oscar Burton of Tyler presided at the morning session. Mr. Still delivered the address of welcome, stressing the importance of uniform rates and practices.

Mrs. E. Hollingsworth of Fort Worth, toll chief operator, and Miss Elma Ballard of Waco, also a toll chief operator, spoke at the morning session. Mrs. Hollingsworth talked on "Report Charges" and Miss Ballard on "Call Orders."

R. H. Cornish, manager of the Gulf States Telephone Company, Commerce, spoke on "Developing Toll Revenues."

"Hube" Rallies Gang to Aid of Luckless Billy Hogan

Oklahoma City, Okla.—Oklahoma Telephone men are rallying to the aid of Billy Hogan, owner of a small telephone exchange at Pleasant Valley, near Guthrie. A letter telling of Hogan's tough luck and his brave battle has been sent to the "Sooner" telephone men by H. W. Hubenthal, telephone engineer for the Oklahoma Utilities association. "Hube" is lining up the state's band for a war fund against Hogan's run of tough luck. Here are excerpts from the Hubenthal letter:

"For several years Billy Hogan, a cripple, unable to walk since childhood, supported his family and mother from meager returns from his small telephone exchange at Pleasant Valley near Guthrie, Okla.

"Recently his wife died from burns received in a gasoline explosion. A few days later he lost his home by fire which also totally destroyed the telephone office equipment, several complete telephones, all materials and supplies. Despite severe handicaps and under the most adverse circumstances Billy, 40 years *young*, is manfully and cheerfully going about rehabilitating things so he may continue to make a living by honest toil, taking a new lease on life, so to speak. He has temporarily re-established his business in a neighbor's home but is greatly in need of assistance to help himself. He is worthy and deserving. One or more dollars from each of us will mean little to us, but a great deal to Billy at this time. Surely all of us can and want to help make up a fund for his benefit to be returned to contributors later on if that is Billy's wish. It will be a most fitting manner to express thanks and appreciation for last year's blessings, materially aiding Billy Hogan during the Thanksgiving season.

"Send your contributions to me, made payable to Billy Hogan, who I know will greatly appreciate whatever you do for him."

Ninety Meet As Guests of Bryan (O.) Company

Bryan, Ohio.—Ninety telephone men and women from the surrounding territory met here as guests of the Williams County Telephone Co. at a district meeting. Motion pictures on telephone history, proper methods of caring for the telephone instrument and depicting the camps where telephone poles are prepared for use, were shown during the afternoon session.

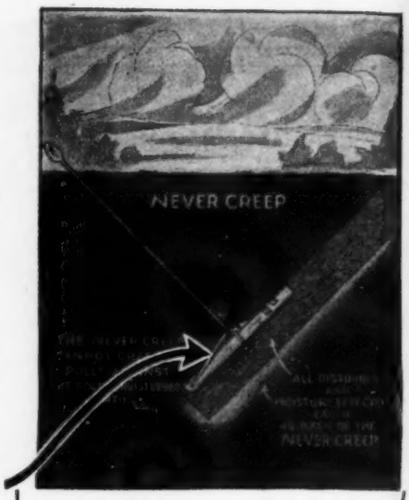
J. J. Foeller of Toledo, division contract agent of The Ohio Bell Telephone Company, talked on business problems as they affect all telephone companies. C. H. Hoover, also of Toledo, made the principal talk on proper transmission.

Accounting problems as they affect the various telephone companies were discussed by P. R. Martz, of Toledo. Mr. Martz is division auditor of receipts of the Ohio Bell Telephone Company, and his department comes in close contact with all independent companies in the matter of long distance accounting problems. He told of Ohio Bell practices and offered the co-operation of his department to all other companies where it could be of assistance.

Miss E. Simon and E. W. Lormor talked on traffic matters.

J. K. Johnston Buys Tremont (Ill.) Plant

Indianapolis, Ind.—J. K. Johnston, sec.-treas. of the Independent Pioneers organization, and a well known telephone engineer, has bought the Farmers' Mutual Telephone Co. with headquarters at Tremont, Ill. The company has approximately 1,200 stations.



In *Any* Soil

Never-Creep Anchors

Have Superior Holding Power

In sandy, moist, adobe, or any other soils, the great holding surface of the NEVER-CREEP and its pull against solid, undisturbed earth gives an anchorage that is unsurpassed.

The more you look into anchor construction and performance the more you realize that undisturbed earth to pull against is a vital consideration. Tamping very seldom suffices to give the holding condition an anchor needs. Moisture seeps down to the holding plate of the anchor and collects there with a great sacrifice of the anchor's rigidity. You know how these factors ruin holding power, so play safe by standardizing the NEVER-CREEP and get away from the perils that are bound to come when the earth is disturbed during anchor installation.

The NEVER-CREEP alone has the Thimbleye rod.

Foremost wire companies prefer the NEVER-CREEP. So will you when you learn its complete story. Write us for details.

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N. SLATER CO., INC.
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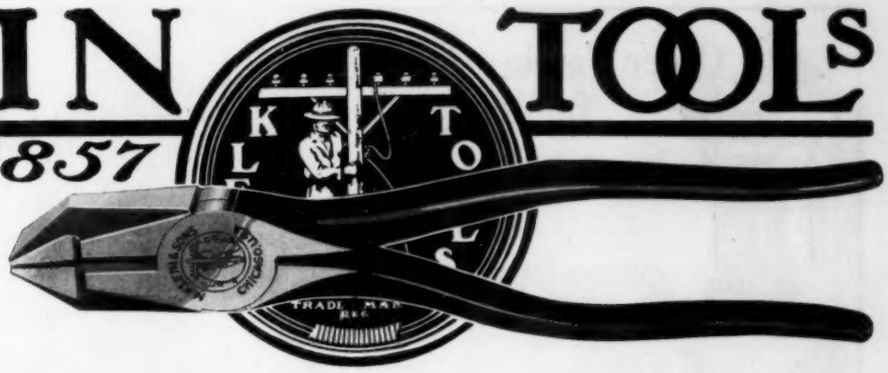
KLEIN TOOLS

Since 1857



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Quick Delivery

Prices and Quality Satisfactory
"Producer Direct to Consumer"

J. J. SEGUIN

Seguin Bldg., 421 St. Paul St.
QUEBEC CITY, P. Q., CAN.

J. K. Johnston, Telephone Engineer

During recent years I have been privileged to appraise Telephone Exchanges all over the United States. The list totals 520. Would you like to avail yourself of my services?

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Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.

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Certified Public Accountants
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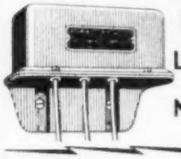

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FREE TRIAL will prove it.

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Kellogg No. 17 ring and talk through Repeating Coils @	$ 2.50
Dean Elec. Co., 4-party Ringing Keys with listening and ringing key mounted on same escutcheon plate @	2.50
Kellogg No. 265 4-party Ringing Keys with listening and ring key mounted on same escutcheon plate @	3.00
Kellogg No. 1041 Key and No. 1033 Key mounted on No. 1013 escutcheon plate @	2.25
H. C. Motor Gen. Ringing Machine. Motor operates off 220 volt, 60 cycle single phase light ckt. Gen. delivers 80 volts, 20 cycles @	75.00
Kellogg No. 53 Common Battery Desk Set complete with either No. 75 or No. 259 straight line steel signal set wired with W. E. Booster ckt. Ind Coil @ $7.25—Harmonic with 16-33-50 or 66 cycle ringer @	7.75
Cook No. 10 Arresters mounted 20 lines per strip, new, per strip @	9.50
Bunnell Telegraph Keys @	.75
Gray No. 11 3-slot wall type pay stations @	5.75
Western Elec. No. 20 3-bar 1000 or 1600 ohm Bdg. Desk Set with Kellogg Transmitters & Rec., @	9.50
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Western Elec. No. 2C Ball type Combine line drops and jacks, per strip of 5 @	7.50

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done at the old reliable
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Highest prices paid for discarded or obsolete telephone and switchboard apparatus; platinum contact relays, ring keys, etc. Have specialized in this field for many years.

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Send for free sample and prices on
UNIVERSAL DROP WIRE INSULATORS
Universal Specialty Company
120-A, S. 7th St., Terre Haute, Ind.

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keep the switchboards and other telephone apparatus free from dust and dirt. One stroke produces a powerful current of compressed air that removes all dust and dirt beyond the reach of a rag. Carried in stock by dealers in telephone supplies, or write direct for literature and prices.

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CEDAR POLES
NORTHERN ✣ WESTERN
BUTT-TREATING - GUARANTEED GRADES
ANY SPECIFICATIONS REQUIRED
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No. 79 Qt. No. 80 Pt. Gasoline-Kerosene

OTTO BERNZ CO. INC.
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Stocks in Newark, N. J., New York City, Chicago and San Francisco.

50 YEARS OF SERVICE

Offices in Newark, N. J., New York City, Chicago, Fort Worth, Denver, Helena, Mont., San Francisco, Los Angeles, Seattle and St. Thomas, Ont.

ALL FULLY GUARANTEED

STANDARD Telephone Cables

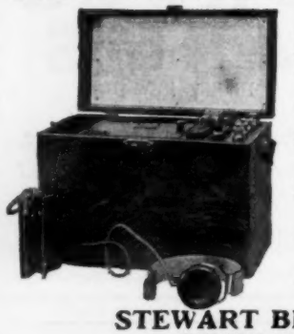
are manufactured from the best materials by skilled workmen. They embody the most advanced ideas in telephone cable manufacture.

If interested in dependable cable at a reasonable price, write our nearest office.

Standard Underground Cable Co.

BOSTON NEW YORK PHILADELPHIA WASHINGTON PITTSBURGH DETROIT CHICAGO ST. LOUIS SAN FRANCISCO

The "STEWART" Cable Tester



Locates shorts, crosses, grounds and wet spots to an inch. Will often save its cost on one case of cable trouble.

Order a "STEWART" Cable Tester and be sure you are going to locate your next case of cable trouble quickly.

Any telephone man can use it. Not an instrument that only an expert can use.

Equipped with two vibrators and an indicating lamp. Write for circular.

Sent on 10 days' trial.

Also, Test Sets, Test Cabinets and Detecto-Meters.

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It is significant, in view of the care with which telephone equipment is selected, that Exide Batteries should be the choice of practically every large telephone system in the country.

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Blake Insulated Staples

Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

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In liquid form EVER-PROTECT is great for overhead work, protecting your cable and messengers against chemical action and other destructive influences.

Ask your nearest jobber for complete details.

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3" bore—2-3 and up to any multiple desired.

Single conduit is 1¼"-2"-2½"-3" bore.

Interlocking single and multiple conduit can be put around cables already installed

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Potter Condensers are American made of the highest quality materials. They are built to full capacity. They are very long lived. They are available in replacement sizes and types for all telephone uses.

Potter Condensers are also supplied for A & B socket power devices, power amplifiers, impedance amplifiers, and other radio devices.

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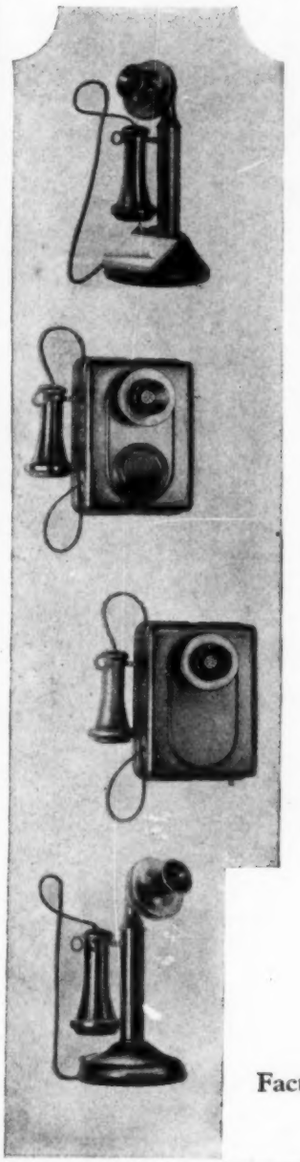
Subject these Telephones to the Most Rigorous Tests



MAKE a definite point-by-point comparison between these Type 21 Common Battery Telephones and any type of telephone you are now using or can secure. Investigate carefully as to durability, quality of workmanship and material, ingenuity of design, convenience of operation, and quality of transmission. We believe you will agree that they represent a standard of development hitherto unattained in telephone instrument design.

Type 21 Telephones incorporate in their construction the best of the many improvements which the past few years have witnessed, together with some new and distinctive ideas that are peculiarly their own. Telephone users are as quick to appreciate their beauty and convenience as operating men are to value their durable finish and construction.

Type 21 Telephones can be furnished for either manual or automatic service, and for any standard type of common battery circuit which may be required to fit your individual needs. They are available with or without dials, or fitted with dial blanks or writing pads for future automatic service.

Write for Bulletin 1002

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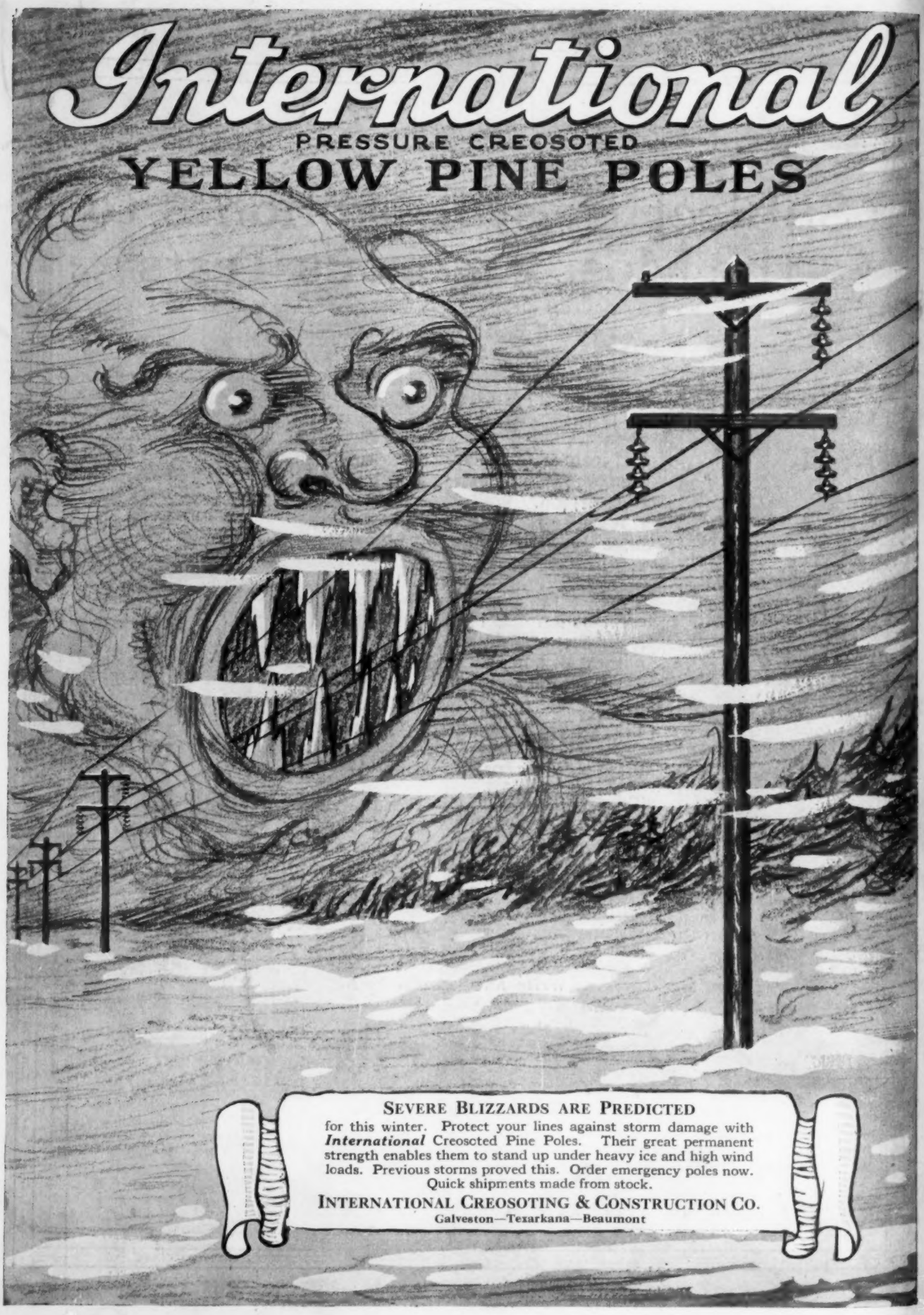
A Style for Every Type of Service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YELLOW PINE POLES
SEVERE BLIZZARDS ARE PREDICTED
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